ENGINEERING AND MINING JOURNAL

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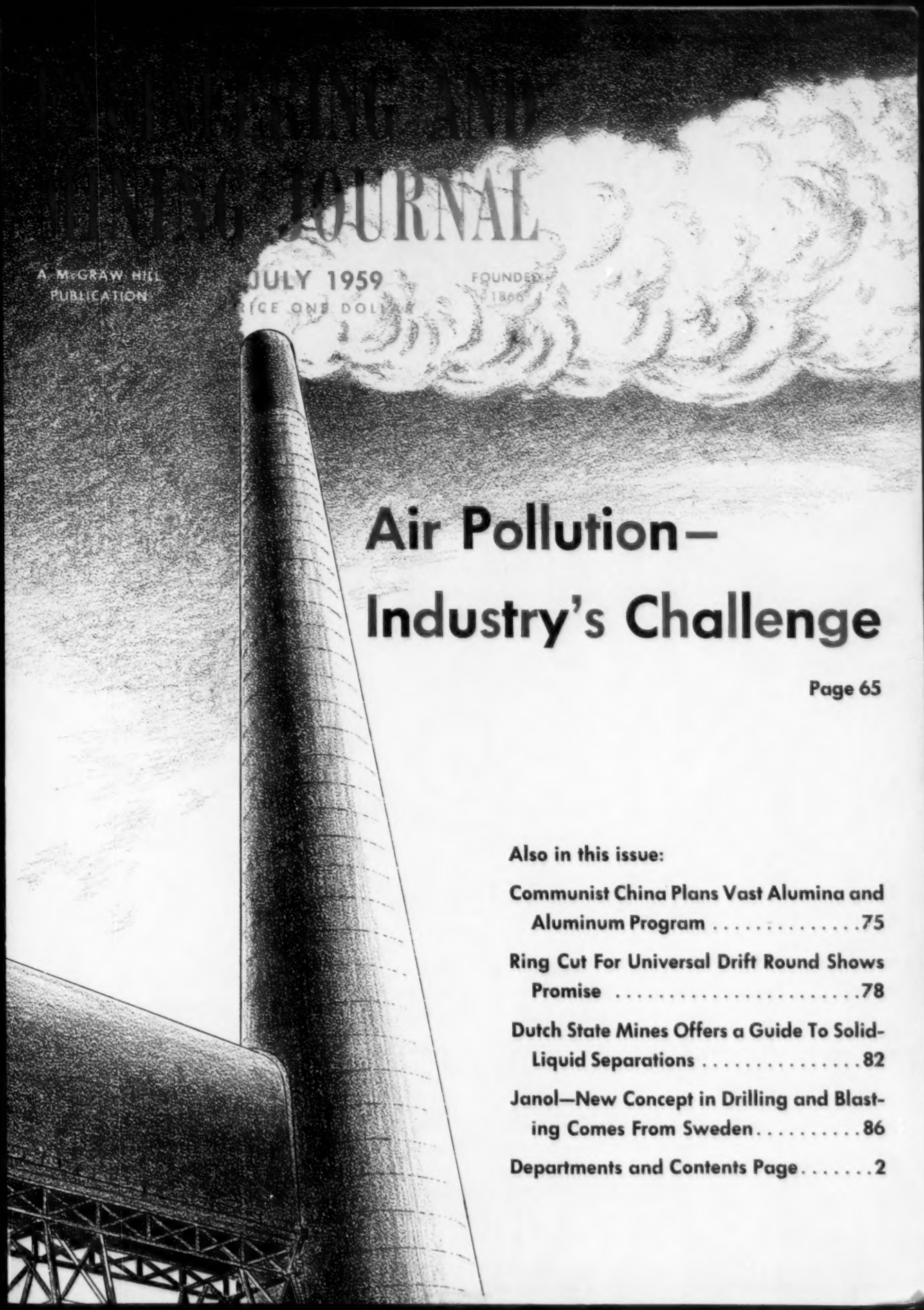

# Air Pollution—Industry's Challenge

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Ring Cut For Universal Drift Round Shows Promise . . . . . 78

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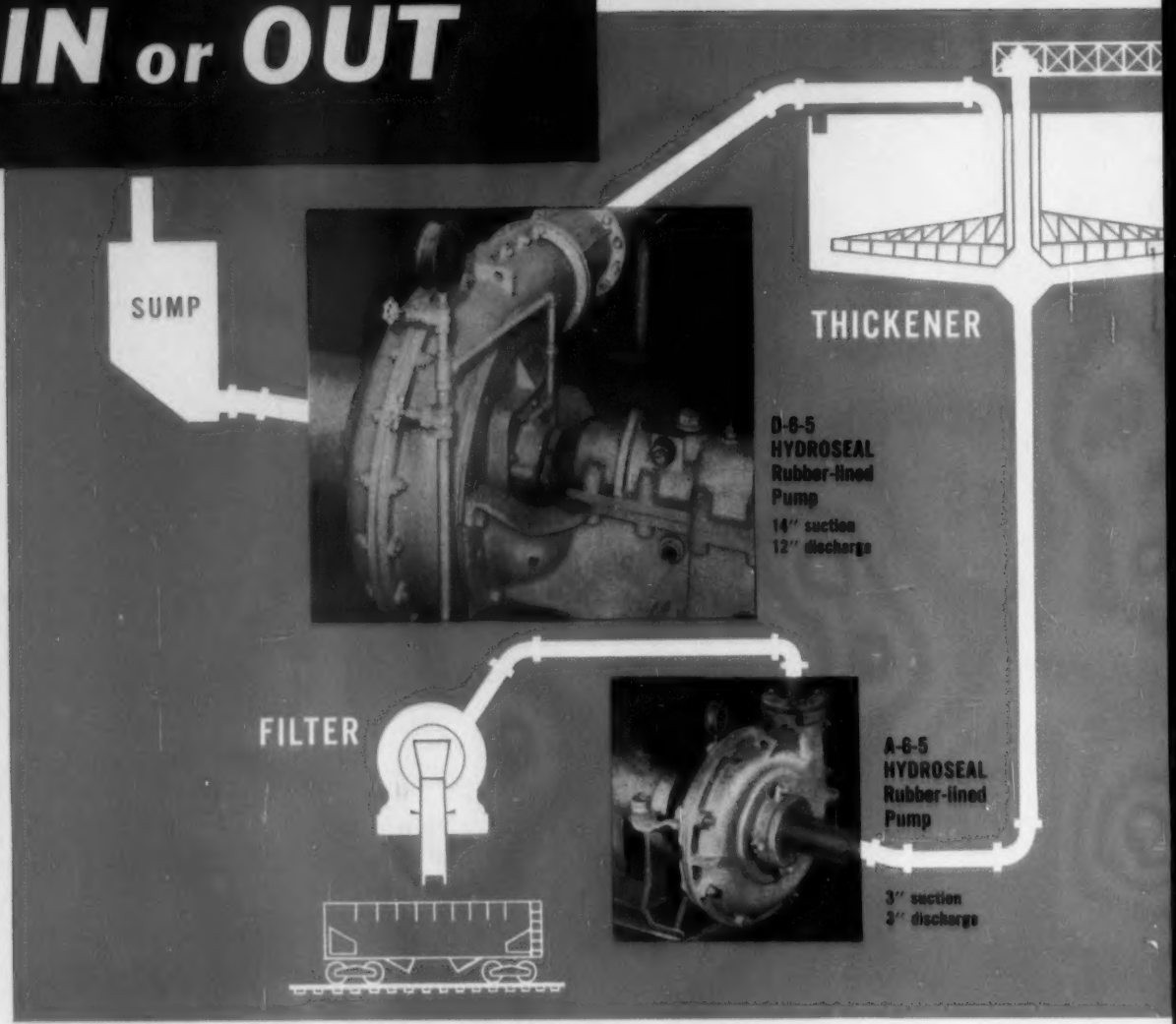
# THIN or THICK
# IN or OUT




**This 14" x 12"** Hydroseal is pumping dilute slurry to a thickener, and a directly-connected **3" x 3"** Hydroseal is pumping the dense underflow to a filter. They typify scores of installations where Hydroseals are proving their superiority in fluid-solids separation. To improve your similar operation, enlist our vast and varied experience. Write to us today.

For information about these split-shell Hydroseal pumps, ask us for Brochure No. 457.

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**Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.**
*Representatives throughout the World*

# HYDROSEAL and CENTRISEAL
**SAND, SLURRY & DREDGE PUMPS**
MAXIMI-X RUBBER PROTECTED

# introducing the ALL NEW SIZE 834 impactool...

1¼" capacity

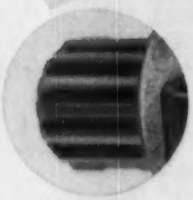
## 25% more power!

## 6¾ inches shorter!

## 7 pounds lighter!

than the size 534

## optional features



### Spline Drive Anvil

For transmission of maximum power to the socket, many prefer the spline drive which is optional. The closer fit and greater driving area also provide increased socket life.

### Swivel Inlet Assembly

Where extreme maneuverability is a problem, the optional swivel inlet assembly makes the hose easier to handle.

### Inside Trigger Handle

Preferred by some operators, the optional inside trigger handle prevents the possibility of the operator's hand being caught when the tool is used in extremely close quarters.

**FREE!** New Form 5248—describes the Ingersoll-Rand 834 Impactool in detail. Contains photos, specifications and lists standard and optional equipment and accessories.

**WRITE TODAY!** Ingersoll-Rand
11 Broadway, New York 4, N. Y.

*for faster run-down, easier operation and better maneuverability in tight spots . . .*

**MOTOR** Powerful new vane-type motor with direct drive to hammer provides greater torque and five times faster run-down. Motor housing is machined from a strong, lightweight alloy.

**IMPACT MECHANISM** New design operates at maximum efficiency to tighten the toughest nuts and bolts. Rated capacity, 1¼" thread size. No kick or twist is transmitted to the operator.

**THROTTLE VALVE** Graduated-action throttle valve permits quick homing of socket on nut. Rubber face provides positive seal; can be quickly and economically replaced when necessary.

Ingersoll-Rand

*Tools plus AIRengineering increase output per man*

# ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

JULY 1959

VOL 160 NO. 7



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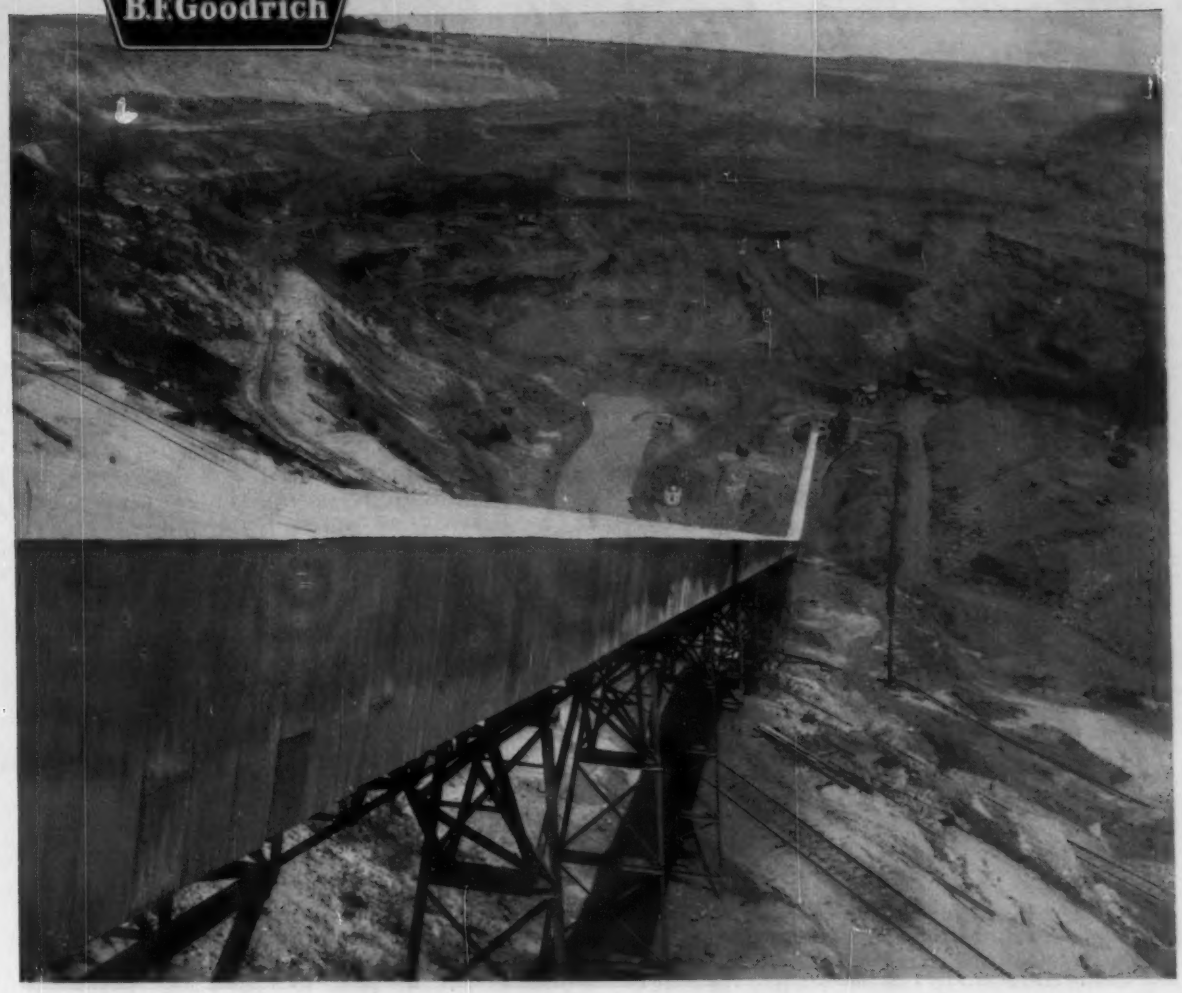



# Nine million tons came up here

*B. F. Goodrich improvements in rubber brought extra savings*

OUT of that man-made hole (so deep a 30-story skyscraper wouldn't reach the top) enough iron ore has come up in the last ten years to make the steel for 2½ million automobiles. A cubic foot of the stuff weighs 125 pounds; it comes up the steep hill, ½ of a mile long, at the rate of 18 tons a minute.

A hole this deep once would have needed at least three belts dumping from one to the other. No belt was strong enough to pull all the weight the whole distance.

Then B.F.Goodrich developed a steel-wire-and-rubber belt, with twisted wire strands running lengthwise, each strand completely surrounded by rubber. There is half a mile of wire in every foot. Now one long belt does the whole job, has carried over 9 million tons, is still in use. It has lasted longer than any conveyor belt ever made with steel cords or cables.

This stronger conveyor belt is typical of what happens when B.F.Goodrich engineers set out to improve a product so that it will last longer, stand more abuse. That's why it pays to call a B.F.Goodrich distributor before you buy rubber products, let him tell you what new developments B.F.Goodrich has made in them.

At this iron mine money was saved by eliminating "transfer points", which would have been necessary in any system built in several stages with ordinary belts. Fewer transfer points meant less expensive equipment in the first place, and maintenance cost was reduced every year. *B.F.Goodrich Industrial Products Co., Dept. M-620, Akron 18, Ohio.*

**B.F.Goodrich** ***industrial rubber products***

# Behind the By-Lines...

## An Editorial

**This is not,** as our more loyal readers will realize instantly, the regular editorial. This is an editorial to introduce an editorial stand. Behind the By-Lines has taken only one other such stand in its history (remember the columbium-niobium donnybrook?) and based on that relative success, feels strong enough to introduce another subject which concerns us deeply.

E&MJ feels very strongly about dictating to its readers. We will not tell you how to run your business. We agree to a man that we best serve you by telling you of the developments in the mining industry which are new, constructive, and valuable, and let you decide which and what will serve you best.

In another context, but with the same high intent, Adolph S. Ochs, the great publisher of the NEW YORK TIMES, outlined his newspaper's code of conduct: "We will tell which way the cat jumps, and trust the public to take care of the cat."

There is an article in this month's issue (p 65) which represents nothing short of a clarion call. The subject is one of the touchiest in modern business journalism: Air Pollution.

As the article, compiled, edited and filled-in by Jim Franklin—says clearly, "we are not interested in sensationalism." Nor are we pushing the sale of filters, collectors or precipitators.

The U.S.—no, the world—population has shown increasing concern recently in the pollution of atmosphere by various contaminants. True, the first reactions came in the sphere of nuclear fallout. But intelligent and wary minds took it from there. More and more, people and periodicals are discussing smog, smoke and soot. In many areas (and in a few Government bureaus) some partisans are gesturing wildly in the direction of the mining industry.

We know, and have tried to say, that the mining industry is vitally concerned with the problems and threat of air pollution. The amount spent by the industry in cleaning up and reducing its waste product is astronomical.

But we have too frequently been talking to ourselves.

Recent trips by E&MJ editors have brought out interesting, and rather unusual, sidelights on the problem.

1) Phosphate producers in Florida frequently maintain orange groves around their plants. Purpose: to make sure that they are not harming the local industry, and that they can prove it with tangible evidence.

2) A sulphur producer in Louisiana maintains extensive oyster beds around its submarine discharge lines. Purpose: the same as above.

Citing the article on p 65:

"The dollars spent for air pollution abatement (by the industry) motivated by a sense of doing the right thing far outweigh the dollars that have so far been spent for economic returns."

"When we come into a town and decide to build a new plant, we make a complete survey: of the town, of the plant area where we propose to build, of population trends, of the meteorology and topography of the area. This we do on our own. Our company has had an air pollution control department since 1930."

Stories like that cannot be buried until the mining industry is under public attack. They must be told long before.

One of the most influential magazines in the United States is undertaking its second campaign in recent history: a campaign against air pollution.

THE NEW YORKER, under the heading "These Golden Days," has for the past several weeks cited case, time and place of pollution and its reported or probable effects. (The title is taken—we hope—from Kurt Weill's haunting "September Song," in which an elderly man sings of his desire to spend "these few precious days" with a woman he loves.)

We repeat: People are more conscious than ever of the dangers of air pollution. The mining industry has been aware of the problem for decades and has fought it constantly.—But we must say so now.

The article in this issue is a beginning. Following its publication, E&MJ plans to canvass the industry to acquire more of the story. Another article will tell you the results of that survey.

**Speaking of** THE NEW YORKER, there's a story that has always pleased us about its dedication to purpose.

Its founder and editor until his untimely death, Harold W. Ross, was a Denver boy who came to Manhattan to teach the locals all about sophistication—and succeeded. He was a man of strong convictions, uninhibited and articulate.

During the magazine's other great crusade—heartily and lustily in opposition to popular music and commercials being inflicted upon travelers in railroad stations and on trains—Mr. Ross offered to testify before the committee considering the permit to the broadcasters.

After long questioning, Mr. Ross was asked what he would do if the committee finally approved the permit and let singing commercials be sprayed upon what Ross called "the Captive Audience."

Ross growled: "I'm thinking of having an eardrum punctured."

# engine power BY CATERPILLAR

# How Cat Diesel power pays off in industrial and mine locomotives

Today, not all industrial and mine locomotives have Caterpillar Diesel power. But the trend is definitely in that direction in locomotives up to and including 70-ton capacity. A locomotive assignment is no "bed of roses" for a diesel. That is why owners insist on the excellent productivity offered by Caterpillar. In both new locomotive purchases and in locomotive repowering jobs, men who demand more work from their diesels specify Caterpillar Diesel Engines.

If locomotives are a part of your production picture, these benefits of Cat power should be considered:

**POWER RESERVE.** Cat Engines deliver power needed to overcome adverse grades and bends. Their high torque rise and reasonable ratings will take heavy loads where "paper" horsepower is left behind.

**WIDE RANGE OF FUELS.** Cat Engines burn many fuels other diesels do not use. This non-premium appetite pays off in several ways: you can burn lower priced fuel . . . and you can burn heavier fuel (per gallon) with more resultant horsepower output.

**FUEL BURNS COMPLETELY.** The nonsensitive, foul-free Caterpillar-built fuel injection system gives complete fuel burning because of its precombustion chamber design. It transforms more of your fuel dollar to work and gives a clean exhaust that does not cloud up tunnels or foul up air underground. A variety of scrubbers, available for Cat Diesels, makes many of these engine arrangements permissible for use underground.

**GOOD BREAKAWAY POWER.** A Caterpillar Diesel-Torque Converter or Diesel Electric Drive enables a locomotive to break away large loads without an assist. This feature eliminates the high clutch costs on a direct drive installation. Most owners who have converted to these methods comment favorably on their advantages.

**NEARBY PARTS AND SERVICE.** Caterpillar Dealer Service facilities are available in all countries of the Free World—over 840 outlets place your Cat Diesel always near a parts and service source. This is why most manufacturers will offer Cat power when nearby parts and service are important factors.

**HEAVY-DUTY DESIGN.** The Cat Diesels that are offered for locomotive power are the same basic engines that have long been standards in the tough construction and mining industries.

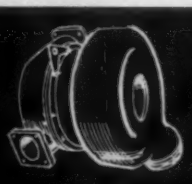
Caterpillar Tractor Co., Peoria, Ill., U. S. A.

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Caterpillar Dealers have cooperated closely with many large construction, mining and industrial companies on the solution to locomotive repowering problems. Your dealer will be glad to analyze your conditions and offer a repowering solution. For new equipment, contact your locomotive branch office or mail the coupon below.

**Your Caterpillar Dealer Engine Specialist is your diesel power consultant. He's backed by quality parts, reasonably priced, and a skilled staff of factory-trained servicemen. Call him now to avoid problems later.**

**TURBOCHARGER — standard on most Cat Engines—gives more horsepower per pound of engine weight . . . improves efficiency by utilizing waste energy which reduces fuel consumption per horsepower-hour.**



Dept. EM7, Engine Division
Caterpillar Tractor Co., Peoria, Illinois

Please have your representative get in touch with me and survey my locomotive power requirements. I am interested in diesel power for ☐ a new locomotive ☐ repowering an old locomotive. (If repowering, specify size of locomotive:_____)

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

# These special steels that do more put money in the bank for you

Today's mining equipment built with USS High Strength Steel, super-strong USS "T-1" Steel or USS Stainless Steel is the biggest, brawniest and most durable ever made. It's true that these steels cost more per pound in most cases, but fewer pounds are needed. They cut dead weight, increase payload, boost service life, reduce downtime and save operating dollars. Every dollar you spend for these stronger, tougher, more abrasion-resistant steels puts money in the bank. For example, "T-1" Steel bucket teeth have outlasted other teeth from five to 10 times . . . and stainless steel filter screens have lasted 50 times as long as the material they replaced.

*USS, COR-TEN, MAN-TEN, TRI-TEN and "T-1" are registered trademarks*

**Here are the USS Steels that do more:**

**USS MAN-TEN Steel**—High strength with abrasion resistance and economy. (Minimum yield point 50,000 psi)

**USS COR-TEN Steel**—High strength with superior atmospheric corrosion resistance. (Minimum yield point 50,000 psi)

**USS TRI-TEN Steel**—High strength with toughness, weldability and abrasion resistance. (Minimum yield point 50,000 psi )

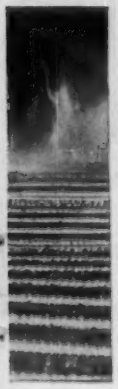
**USS "T-1" Steel**—Super strength with impact abrasion resistance, weldability and toughness. (Minimum yield strength 100,000 psi)

**USS STAINLESS Steel**—High resistance to corrosion, elevated temperature service and abrasion.

Each of these USS Steels is superior for certain applications. Our metallurgists will help you choose the best steel for your job. Contact our nearest sales office or United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

**High Strength Steels in Alaska.** Located 100 miles out in the bush, with the responsibility of mining 75,000 tons of coal annually, this earth-moving equipment hacks, dozes, hauls and scoops both coal and overburden the year round. Bulldozer blades and shovel buckets must be tough and independent—able to withstand extensive periods of 30° below zero weather. High strength steels stand up under this brutal punishment—keep production moving.

**Stainless Steel vibrating screen** handles more than 400,000 tons of run-of-mine coal at Island Creek Coal Co., Holden, W. Va. Present unit has lasted more than a year. Cost of screen runs about 0.3 cents per ton of coal processed. The same story of low-cost operation holds true at other mines where stainless steel is doing yeoman duty. Stainless Steel coal chutes eliminate the build-up of coal caused by week-end corrosion of the old chutes. Service life is greatly increased. Stainless vacuum filter screens remain in service a year against only a few weeks for previous screens.



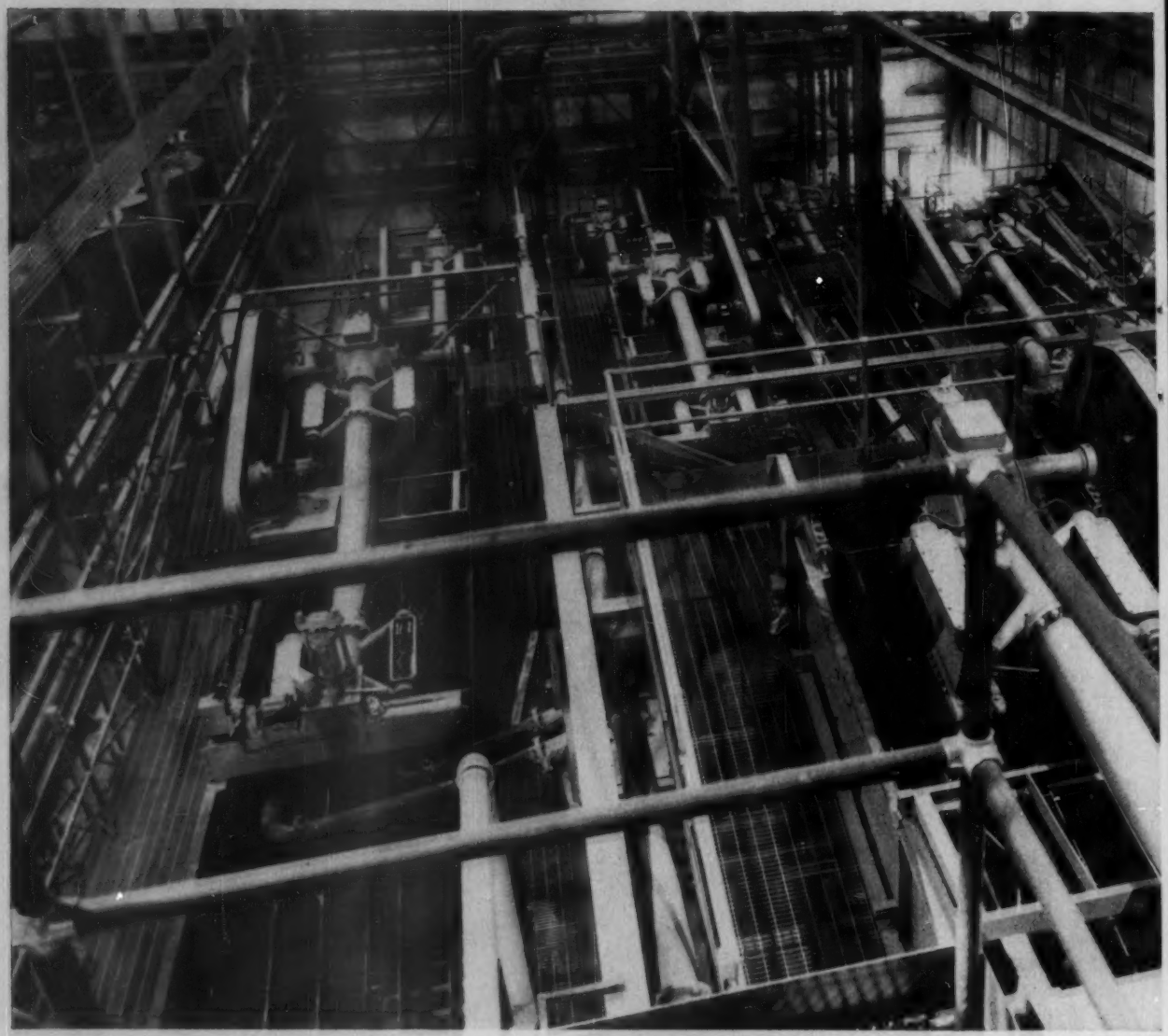
**5 times the life from USS "T-1" Steel.** This 18-cu.-yd. shovel bucket has lips and teeth made from USS "T-1" Steel. The old teeth made of mild steel lasted about 80 hours. Another alloy lasted 160 hours. Now, with "T-1" Steel, they get a whopping 400 hours minimum. USS "T-1" Steel's outstanding resistance to impact abrasion made the difference and resulted in large savings. The teeth cost about $100 apiece. Now most of this is saved by the drastic cut in maintenance costs.

United States Steel Corporation – Pittsburgh
American Steel & Wire – Cleveland
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

**United States Steel**

USS

# THICKENING AND CLASSIFICATION IN

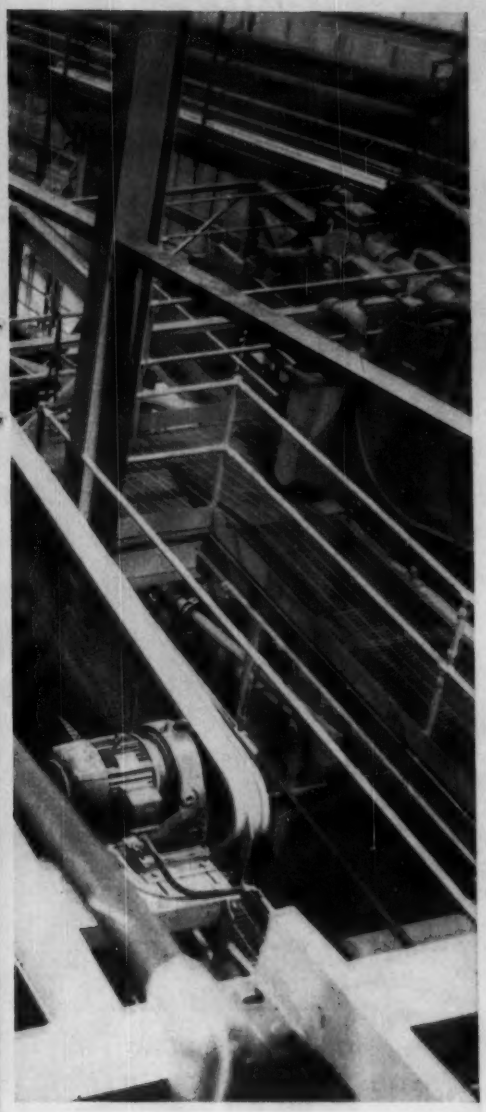


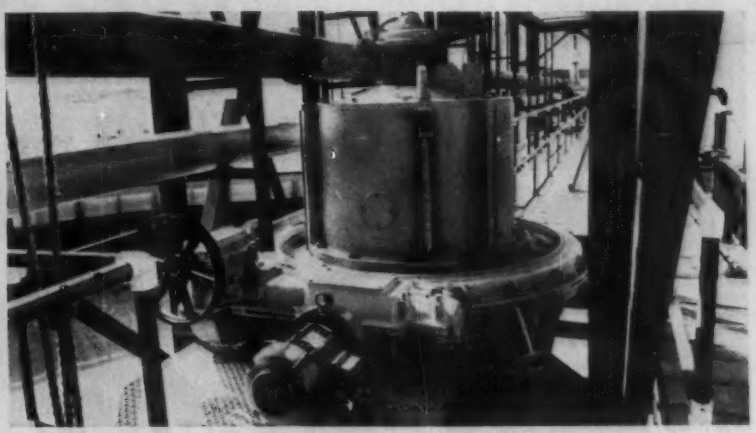
*Kermac Nuclear Fuels Corporation uses Dorr-Oliver equipment in giant New Mexico operation*

The 3,300 TPD acid leach uranium mill of the Kermac Nuclear Fuels Corporation ranks as one of the most spectacular operations in the huge uranium ore processing center that has grown up in the Grants, New Mexico, area.

A feature of the mill is its use of heavy duty Dorr-Oliver equipment in the thickening and classification circuits. The six Dorr C.C.D. Thickeners installed, each 120′ in diameter x 17′ C.D., with rubber covered underwater parts and stainless steel blades, are the largest center shaft or overhead suspension type thickeners ever manufactured. Underflow from the thickeners is handled by batteries of Dorrco rubber lined duplex diaphragm pumps, three for each thickener. Sand-slime separation is made at 100 mesh by hydraulic cyclones, and the sands are washed in two parallel circuits with a total of ten Dorr

# 3,300 TPD ACID LEACH URANIUM MILL

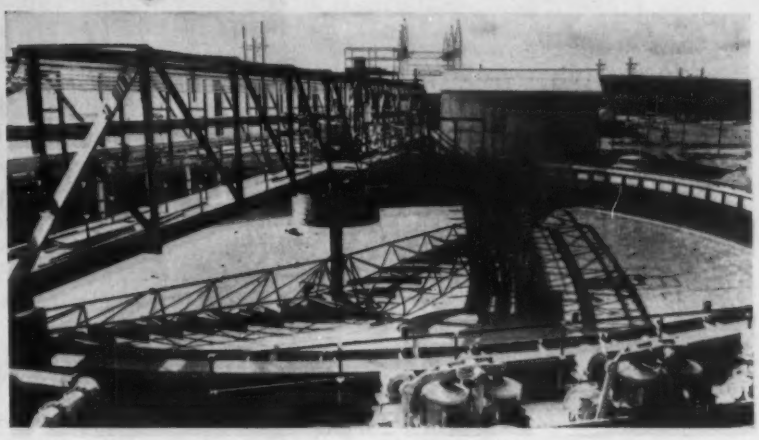




DORRCO THICKENER DRIVE HEAD shows massive design. This unit features balanced double reduction worm gear and motorized lifting device to lift thickener rakes 24 inches.

C.C.C. SANDS WASHING CIRCUIT includes ten Dorrco rubber lined Classifiers, each 6′ wide x 33′ long. Photo shows arrangement in two parallel circuits.

DORRCO COUNTER-CURRENT DECANTATION THICKENER, 120′ diameter, is one of six installed in the "B" circuit. Also shown in this photo are the Dorrco rubber lined duplex diaphragm underflow pumps, three of which are used with each thickener.



rubber lined classifiers, each 6′ wide x 33′ long. Classifier blades are stainless steel.

The know-how behind each unit of Dorr-Oliver equipment is based on more than half a century of world-wide experience in metallurgical processing. Whether your requirements be for individual equipment or a complete design and consulting service, D-O can be of help to you. For complete information, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

Dorrco—Trademark of Dorr-Oliver Inc., Reg. U. S. Pat. Off.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

# Special report to Caterpillar D8 Tractor owners:

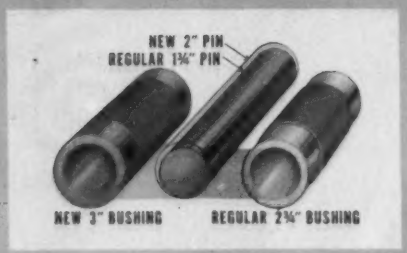
CAT CATERPILLAR

Parts you can trust
Dependable round-the-clock service

## NEW TRACK COMPONENTS AVAILABLE FOR MOST D8 TRACTORS... GIVE UP TO 44% LONGER LIFE

**Caterpillar's continuous research and testing pay off for you with the development of superior D8 track components. The next time you replace track parts, specify these new components. They last longer and require less maintenance. Here's what's available for 2U, 13A, 14A and 15A tractors:**

**30% STRONGER PINS AND BUSHINGS** have more wear area to extend life. The big track pins are ¼" larger in diameter and heat-treated deep to resist wear . . . pins will not bend and cause uneven wear. The large contact areas of the bushings are hardened deep, both inside and out. Under field conditions these bushings have lasted up to 44% longer than regular bushings.

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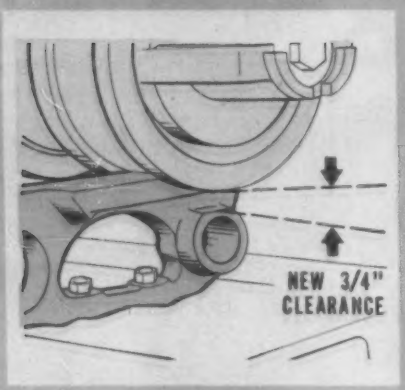
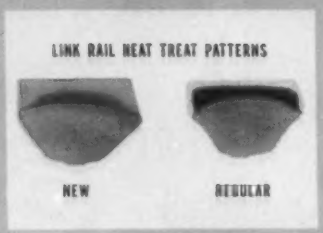
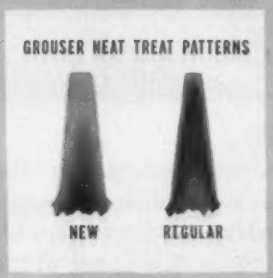



**STRONGER, LONGER, HIGHER TRACK LINKS** are 3 lb. heavier, 1" longer and ¼" higher. New length means fewer track sections are required. Increased height gives up to ¼" more *link pin boss-roller flange* clearance. Improved steel used in these links permits 80% deeper rail hardening and greater strength—pins and bushings stay tight *in the links* even under the roughest application.




• • •

**NEW TRACK SHOE GROUSERS ARE 20% THICKER** at the tip and are hardened much deeper than on regular shoes. The new shoe as a whole is bigger and heavier to resist bending, impact and wear. Track hardware used with the new track components is stronger—bolt diameter increased from ¾" to ⅞".

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**NEW DESIGN BORALLOY SPROCKET REPLACEMENT RIMS** are available to accommodate the increased pitch of the longer links and bigger track bushings. Teeth are precision-machined to provide exact fit with track bushings—a major contribution to longer bushing life.

**SEE YOUR CATERPILLAR DEALER** for more information on extending your D8 track life. He has parts you can trust and round-the-clock service. See him today.

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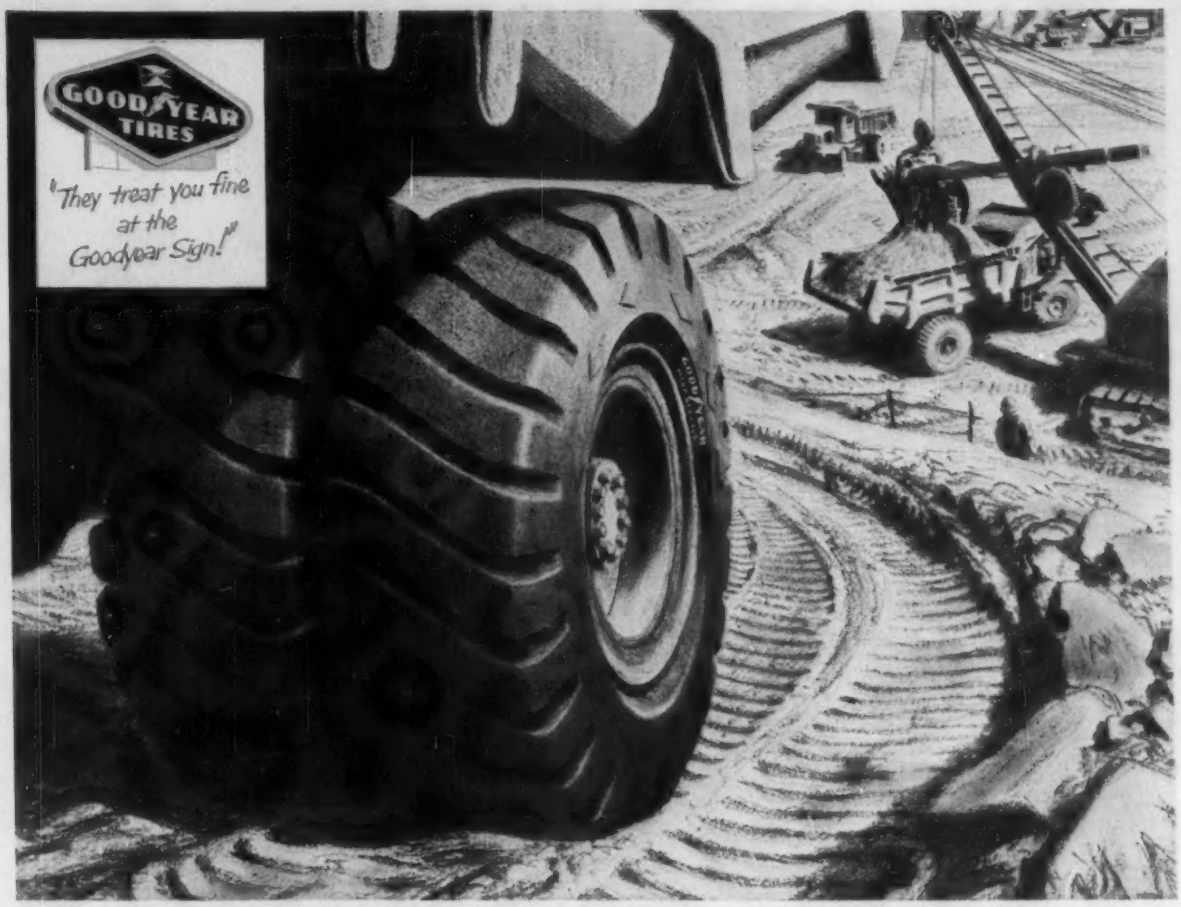
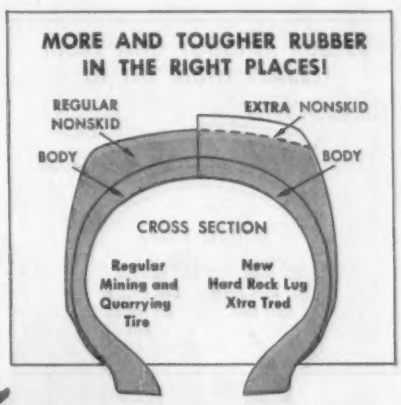



# EXTRA TREAD TO TAKE IT WHERE THE GOING'S EXTRA TOUGH!

## *NEW HARD ROCK LUG XTRA TRED*

*Specially Engineered Tire for Mine and Quarry Work*

More and tougher rubber in the right places—exclusive Triple-Tough 3-T Nylon Cord to back it up. That in a word is why this great new Goodyear tire tops its class. Specifically designed to take the hard knocks, the Hard Rock Lug Xtra Tred—with 18% more tread rubber, reinforced lugs, bonus shoulder heft and huskier sidewalls—stands up under tough punishment that kills lesser tires in short order. And thanks to 3-T Nylon Cord, greatest tire saver in 24 years, cuts, bruise-breaks and blowouts are reduced to an all-time low. Get full details from your Goodyear dealer now. Goodyear, Truck Tire Dept., Akron 16, Ohio.




# GOODYEAR

Xtra Tred—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

**USS Tiger Brand Amerclad Cables** are built tough and strong to withstand dragging over sharp rocks, and exposure to sun, rain, grease and oil.

*Right*—Strength and flexibility of Amerclad are shown by its use over this cable bridge leading to a power shovel.

*Far right*—Vibration resistance of the Amerclad Cable is the main reason for its use on this railroad track tamping machine.

USS **Tiger Brand Electrical Wire & Cable**

**A standard cable for every special job**

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
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- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

# What's the difference in electrical wire and cable?

Even though electrical cables may look alike and start with some of the same materials, there's a *real difference* in the completed cables.

The difference in USS Tiger Brand Amerclad Cables results from a combination of research, engineering and construction. The development of better materials goes on constantly at American Steel & Wire. Insulation and jacketing compounds have been improved.

Better stranding designs and methods of stranding add years to cable life.

Amerclad Cables are protected by an outer jacket of Amerprene, an oil resistant compound containing a high percentage of Neoprene. Before being vulcanized, an Amerclad Cable is encased in a substantial lead sheath that is afterward removed. The pressure developed within this rigid mold during the vulcanization process produces a dense, non-porous jacket that is highly resistant to abrasive wear.

Knowledge of severe field conditions obtained through sales engineers permits designing for special conditions.

Constant effort to control quality and improved methods of inspection assure a product of highest quality.

These are a few of the unseen plus values you get when you buy Tiger Brand Amerclad Cables for your shovels, dredges, continuous miners, drills, shuttle cars and other equipment. For complete technical information, write for our free book, "Tiger Brand Amerclad Cord Cable," American Steel & Wire, Room 9163, 614 Superior Ave., N.W., Cleveland 13, Ohio.

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USS **American Steel & Wire Division of United States Steel**

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
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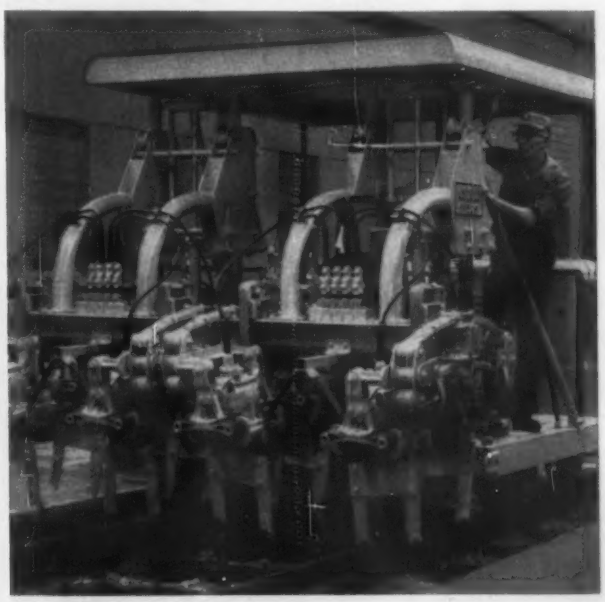

# FROM THE MEXICAN TO CANADIAN

BORDER

# *One P&H sells another because*

# P&H "PROFIT·TONS" reduce loading costs... even in hardest digging

Up to 30% higher bail pull—faster swing—exceptional physical strength of P&H welded construction—greater job availability all add up to as much as 10% more production, lower loading cost per ton and *more net profit* for owners of P&H Electric Mining Excavators on their hardest digging assignments.

P&H "Profit-Tons" are the end product of these *exclusive* P&H design principles:

MAGNETORQUE' . . . the most productive digging motion drive known for electric excavators. This *patented* P&H drive electro-magnetically transmits full digging power from an A. C. hoist motor direct to the dipper without motor generator set conversion to D.C. current. It gives higher bail pull, better dipper fill factor and automatic impact protection to the digging machinery.

ELECTRONIC CONTROL . . . the most responsive control for electric excavators. This *patented* P&H control accomplishes the quickest work motion reaction time and gives the greatest cycle productivity known.

In addition, with P&H—and only with P&H—do you get the service assurance of single source responsibility. P&H manufactures their own electrical as well as mechanical components—*designed specifically for electric excavator service.* Write Dept. 556, Harnischfeger Corporation Milwaukee 46, Wisconsin.

**P&H LINE:**

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| Electric Excavators: | 3½ through 10 yds. |
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| Truck Cranes: | 10 through 80 tons |

**P&H MINING EXCAVATORS**

**HARNISCHFEGER CORPORATION**
**Construction & Mining Division**
**Milwaukee 46, Wisconsin**

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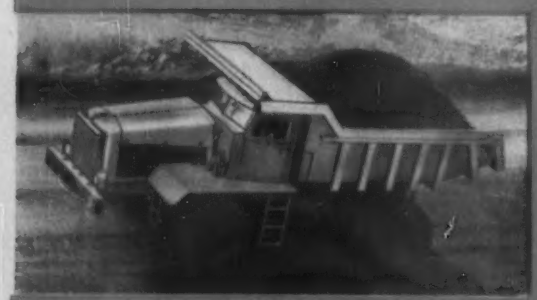
## no other mine truck can equal on any job!

## ONLY *Oshkosh* MINE TRUCKS



**give you 2-axle all-wheel drive traction for hauling 30-ton payloads up steep grades, around tight curves, on roughest roads!**

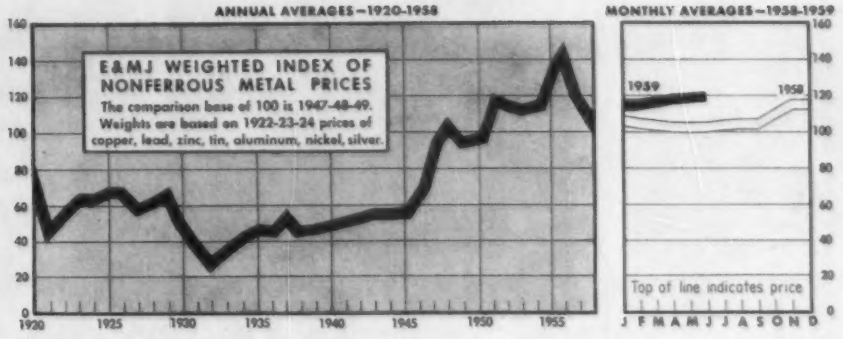
This unit is no "fair weather" operator. It's on the job 24 hours a day. Wet clay, mud, snow, rain, ice, sleet doesn't stop an Oshkosh— it just keeps going! We have the **traction** answer for you — and it's not a pusher unit. Ask for a free demonstration of the Oshkosh Mine Truck with ALL-WHEEL DRIVE Traction. No obligation, of course. Write or phone today!

**OSHKOSH MOTOR TRUCK, INC.**

*42 years under the same ownership and management*

**OSHKOSH** **WISCONSIN**

# E&MJ OUTLOOK




**MARKETS**

**E&MJ'S nonferrous metal** price index moved up slightly from 120.9 for May to 121.0 for June, reflecting a 0.1c increase in the lead monthly average which outweighed decreases in the copper and tin average prices.

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**AT HOME**

**Prospectors take note.** The deadline for completion of assessment work on unpatented mining claims for the 1958-59 year is Sept. 1.

**Average starting salaries** for mining engineering graduates at Lehigh University were 12% higher than last year. For mining engineers, the salary average moved up from $438 in 1958 to $490 in 1959.

**Woodward Iron Co.** has acquired mineral rights to a 100-million-ton iron ore deposit west of the Edgewood Lake dam in New Jersey. Development of the underground mine may not be started before five or ten years, according to J. E. Urquhart, chairman of the company.

**Republic Steel Corp.** is developing a process to produce strip steel directly from iron concentrates. The process involves the direct reduction of concentrates to iron powder, rolling the powder at high pressure and heating the resulting strip.

**Detroit auto makers now estimate** that car sales, including some 500,000 foreign cars, will exceed the 6-million estimate by 180,000 to 240,000 units for 1959. Prosperity of the metals industry is more closely geared to the auto industry than to any other single industry. Manufacturers of batteries, mufflers and other accessories for cars expect sales for 1959 to exceed the $4.4-billion total by 7 to 10%.

**Lignite reserves in North Dakota** total approximately 350-billion tons, averaging 6,000 to 7,000 btu per lb. Governor John Davis has invited the aluminum industry and others to consider South Dakota's energy resources in planning for future plant sites.

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**LABOR**

**As June ended,** the drift of negotiations between major copper producers and labor unions indicated that there would be no nationwide strike in the copper industry. In the general picture, copper negotiations appeared to be riding with steel settlements.

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**ABROAD**

**Soviet Russia has announced** that it will exploit diamond deposits occuring in pipe formations scattered over a 30,000-sq mi area in the Yakut Soviet Republic, central Siberia.

**Matthiessen & Hegeler Zinc Co.** announces through the Sherbrooke Metallurgical Co., Ltd., that it will build a zinc sulphide roasting plant and sulphuric acid plant at Port Maitland, Ontario. The plant will use the fluid bed principle, and will be operated under license from New Jersey Zinc Co. Sulphuric acid will be sold under long-term contract to Electric Reduction Co. of Canada, Ltd., which plans construction of a large chemical plant at Port Maitland.

# THIS MONTH IN MINING

**OVER 80%** of the country will be flown and mapped to pinpoint prime targets.

**DOPPLER RADAR** will guide the survey plane over the dense, tropical rain forests with few landmarks, where another "Canadian Shield" may lie hidden from view.

# Surinam Starts Operation Grasshopper

SURINAM HAS LAUNCHED "Operation Grasshopper" with high hopes (since earlier studies show mineralization similar to that in the rich Canadian Shield may be present) and with a formidable jump by contracting for a 60,000-mile aerial survey at a cost of about $700,000. Aero Service Corp., Philadelphia, and its affiliate, Canadian Aero Service Ltd., Ottawa, will carry out the work.

Operation Grasshopper first calls for geologic evaluation of 80% of the country through the study of existing air photos seeking guides to more detailed flight grids. Eventually, the detailed geological and geophysical data will lead to some drill holes in promising locations.

Grasshopper will be a four-pronged attack: 1) selecting prime targets by aerial survey; 2) delivering bulldozers by helicopter to hack out jungle air strips at supply bases; 3) fanning out from the bases to cut out strategic helicopter bases; and 4) moving in of ground crews for a closer look.

According to the government, the newly announced plans are just a part of a seven-year development program for the country. "Surinam is actively negotiating further financial aid for this program, and it is encouraging long-range natural resource development through private enterprise," said Minister of Development, Dr. Frank Essed. Photogeologists began arriving in Paramaribo the third week of June to study the air photos. Promising areas will be flown at a height of 500 ft over the dense, tropical rain forest with a Gulf magnetometer and a Mt. Sopris scintillometer.

Since there are no landmarks in the heavy jungle, the survey craft, a modified DC-3, will be guided by Doppler radar which Aero Service pioneered in the Libyan Desert and Spanish Sahara in 1958, flying over 100,000 sq miles without using ground stations, aerial photos or maps. In Surinam, Doppler radar will guide the plane over gridded flight lines spaced at one-half mile intervals.

Record tapes from the first flights will be available for study in early August. It has been estimated that it would take ten years of ground reconnaissance to do the same work that Aero Service hopes to do in a year—provided they get a break on the weather. Surinam wants the results as soon as possible, certain in the knowledge that valuable deposits of iron, uranium and other minerals will be found beneath the green canopy.

## Huge Underground Blast Planned by Soviets To Break Two-Million Tons of Rock

SOME 550 tons of "Ammonite" type explosive are expected to be used to break a 2-million ton block of nonferrous ore in a single blast at an underground mine in Eastern Kazakhstan, according to TASS of June 13th. The block, about 200 ft high, has a base nearly 400-ft square on a level about 1,000 ft below the surface in the Altai Mountains. The blast is expected to be felt strongly on the surface.

According to the report, some 500,000 metric tons were broken in a recent test at another location, using about 190 tons of explosive placed in 23,000 ft of drillholes. Its success led to tackling the larger blast now planned.

Even the 190-ton blast ranks as the largest single blast ever made for underground mining purposes, according to E&MJ records. However, the largest nonnuclear blast of any type was the 1,400-ton coyote tunnel shot of April 1958 which broke some 155,000 cubic yd of rock off the underwater pinnacle of Ripple Rock shoals north of Vancouver, B.C.

The largest quarry blast reported is Morrison-Knudsen's side-hill coyote tunnel shot of 1,060 tons in January 1958 which produced about 4-million tons of rip-rap for the Salt Lake railroad causeway. A number of other surface breaking blasts ranging from 150 to 900 tons have also been made—the most recent being Reserve Mining's drillhole blast of 313 tons in August 1958 which broke some 1.1-million tons of taconite with 31,000 ft of hole.

A glory hole blast of 150 tons at Algoma Ore Properties (Ontario) in 1955 used a combination of surface and underground drill holes to break 1.1-million tons; and a somewhat similar blast of 132 tons at Cananea Copper (Mexico) in December 1957 broke or caved an estimated 5.5-million tons.

For underground drill hole blasts, the next largest is Cananea's 56-ton shot in August 1956. It was placed in 197,602 ft of diamond drill holes and broke or caved an estimated 1-million tons. With such a contrast in hole footage, the 190-ton Soviet shot must have been with very dense explosive and very large drillholes —averaging 17 lb/ft.

In nuclear blasting, two of the shots in the underground test series by the U.S. AEC in October 1958 were only about 90 tons equivalent TNT in size. One other shot, however, had a yield equivalent to 23,000 tons of TNT.

**WORKMEN** rebuild one of the roasters at Utah Division's Magna mill.

## Kennecott Modernizes Molybdenum Recovery

UTAH COPPER DIVISION, Kennecott Copper Corp., has moved to modernize heat-treatment of moly concentrates to effect better recoveries.

The moly concentrates must be heated in order to drive off chemical reagents utilized in flotation of copper. After heating, the moly is refloated to obtain higher values. Any presence of reagents impairs latter refinement.

Utah Copper produces some 1,750,000 lb monthly of molybdenite. The firm didn't say how much it would hike production by improvements in concentrates heating. But it also recovers substantial amounts of molybdenite at Chino and Nevada divisions.

## Mining Calendar

**Institution of Mining Engineers Symposium** on Shaft Sinking and Tunneling, Olympia, London, July 15-17.

**1959 Convention, American Mining Congress,** Denver, Colo. Sept. 14-17.

**International Symposium on High Temperature Technology** arranged by Stanford Research Institute, Asilomar Conference Grounds, Calif. Oct. 6-9, 1959.

**Ninth Annual Exploration Drilling Symposium,** Pennsylvania State University, University Park, Pa. Oct. 8-10.

**Eighth National Clay Conference,** University of Oklahoma, Norman, Okla., Oct. 12-14.

**Annual meeting,** AIME, New York, Feb. 14-18, 1960.

**Australasian Institute of Mining & Metallurgy, Adelaide Branch, Symposium on Hydrometallurgy,** "Wet Processing of Minerals and Industrial Products," Feb. 16-19.

# *As We Went to Press . . .*

**Banner Mining Co. has developed** one orebody near the Pima Mining Co. property and has let a contract to sink a five-compartment shaft into another multi-million ton (4% Cu) orebody next to the Asarco holdings in the Pima district. Banner is negotiating with both Pima and Asarco over a lease or sale of the two parcels. Also, Phelps Dodge Corp. is doing exploration drilling within 500 ft of Banner's boundary near the Morenci pit.

**Wind River formation gypsum** may soon be processed into wall board and plaster at Lander, Riverton or Shoshoni, Wyo.—Vipont Mining Co. is considering a $10-million mine and mill to open a 100-million ton deposit. Indian royalties have been arranged.

**In the Tintic District,** Bear Creek is reported to have one core drill below 1,050 ft that over an 80-ft length averages—20 oz Ag, 20% Pb and 20% Zn. On the 1,050 level, a drift ran into a vein of fine lead-silver assaying about 60% Pb.

**Rio Tinto is pushing a big Canadian** exploration program this year with teams in almost every province. Rio Tinto and firms in which Rio holds interest will spend $900,000 on 1959 exploration.

**In Eastern Transvaal,** Bracken Mines and Leslie Gold Mines have been formed by Union Corp. to open up one new gold mine each near Winkelhaak, Union's youngest mine. Another may be in the works.

**Work will get under way this summer** on the 400-mile railroad into Pine Point, NWT, to open up a vast mineral-rich region abounding in lead, zinc, copper and gold occurrences. The railroad will cost about $70-million and the parallel highway another $100-million.

**Japan,** a prime importer of raw materials, has formed a monopoly to import nickel ores to prevent further price gouging. Also, Japan will import 335,000 tons of iron ore from Brazil this year.

**Sunshine Mining Co.** will deepen the workings another 300 ft to examine an encouraging area at the 4300 level.

**J. R. Simplot has taken over** actual management of Anaconda's Conda, Idaho, phosphate facility. Output will be stepped up to between 250,000 and 300,000 tons of acid-grade rock a year.

**In Quebec, Barnat Mines,** which last year operated at 591 tpd and planned to reach 1,300 to 1,400 tpd this summer, has found enough gold ore to justify plans for 2,000 tpd in 1960.

**Jones & Laughlin Steel's Jalore Mining Co.** has resumed exploration and engineering studies of its iron ore holdings in Boston Twp., Kirkland Lake, Ontario.

**Columbia-Geneva Div.,** U.S. Steel Corp. has purchased 1,120 acres of placer claims and 1,200 acre ft of water rights from Christina Lake. Land belonged to Wyoming Mica & Metals Corp.

**This Month in Mining continues on p. 98 with more features and regional news**

# WASHINGTON IMPACT

## Highlights

**TRADE, NOT STOCKPILES & SUBSIDIES**—As Washington's hottest current policy battlefield for domestic metal-mineral producers, U.S. foreign trade issues have replaced questions of Government stockpile disposal and Federal subsidies.

Two of three recent developments affecting trade policy point toward a more liberal trade stand by the Administration. One hints possible new import protection for two metals, lead and zinc. But the over-all direction is far from clear-cut, and both proponents and opponents of freer trade are reading favorable signs into the news.

Here are the key trends to watch:

● **What role for Commerce Department?** Apart from many other controversial factors involved in the Senate's refusal to confirm Lewis Strauss as Secretary of Commerce last month, one side effect was the removal of a man who stood for tighter curbs on trade policy, a louder voice for Commerce Department in setting it.

Metal industries remember well Strauss' clamping down on exports of copper to the Communist Bloc, only a few months after it had been taken off a restricted list of items which generally are not shipped to the Bloc. Lesser known was Strauss' stand in favor of import protection for domestic oil, textile and other producers.

As this issue of E&MJ went to press, Strauss' successor had not been named. But whoever his successor, he will be more liberal trade-minded than Strauss. Among the names mentioned as possible successors are Eric Johnston of the Motion Picture Assn. and Chairman of the Liberal Committee for International Economic Growth, Charles Percy of Bell & Howell Co.—a staunch supporter of freer trade, and Charles A. Taft, brother of the late Senator and Chairman of the Committee for a National Trade Policy, the liberal trade lobby.

If, on the other hand, the cabinet post goes to Commerce Undersecretary Fred Mueller, he may follow Strauss somewhat more closely.

● **Defense essentiality?** Last month's finding by Defense Mobilizer Leo A. Hoegh that imports of heavy electrical equipment are not threatening to impair the national security cast considerable doubt on the potential trade protection available under Section 8 of the Reciprocal Trade Agreement Act, the defense-essentiality clause.

Hoegh's ruling cannot be interpreted as a sure indication that similar petitions pending for cobalt, fluorspar and tungsten will be dismissed also. But the decision was a political victory for freer trade, because Hoegh specifically cited the "defense-essentiality" of good international trade relations with other countries in reaching his conclusion.

Further and more significant, Office of Civil & Defense Mobilization staffers working on the three mineral cases are reported to be unconvinced as yet that a strong case for additional import protection is required in the interest of national security.

Nevertheless, the electrical equipment decision proved that it is politics, not economics, that will basically determine the outcome of Section 8 cases. This boils the issue down to a question of who has the most political power in any given case—proponents or opponents of new import protection.

● **Lead-zinc to Tariff Commission again?** If Strauss' departure and Hoegh's electrical equipment ruling point toward freer, rather than more restrictive trade policy, domestic lead and zinc producers think they have a chance to swing the Administration around in their particular case.

In a complicated maneuver, more than 20 mining-state Senators last month lined up behind a bill by Sens. James Murray (D-Mont.) and Gordon Allott (R-Colo.) to set 15½c/lb "peril points" on lead, 13½c/lb on zinc. If domestic prices dropped below these levels, under the proposed legislation, 4c/lb tariff rates would automatically be imposed. Rep. Wayne Aspinall (D-Colo.) introduced a similar bill in the House to impose quotas at those domestic price levels.

Congress has not legislated a tariff boost or quota in nearly 30 years; but the mining bloc strategy is this: at the same time, western Senators are planning to get Senate Finance Committee to order the Tariff Commission to conduct a third "escape clause" investigation on lead and zinc.

## Congressional Maneuvers Explore For Mining Policy

CONGRESS' ROLE as a forum for mining policy debates is being played to the hilt this month. Here is a rundown on the legislation, hearings, and behind-the-scenes maneuvering in the works:

Chairman Wayne Aspinall (D-Colo.) of the House Interior Committee kicked off his broad hearing on Government metal-mineral policy last month. Aspinall, in announcing the investigation, cited depressed market conditions he said are currently plaguing a long list of domestically-produced commodities, including beryl, cobalt, chromite, columbium-tantalum, fluorspar, lead, tungsten and "others".

On the agenda to testify was a large cross-section of witnesses, starting with Congressmen and including State as well as Federal mining officials, local and national mining trade associations, representatives of companies and labor unions.

No specific legislation is expected to result from the Aspinall hearings. They are directed rather at laying domestic mining problems on the Congressional record—much as Aspinall's counterpart, Chairman James Murray (D-Mont.) of the Senate Interior Committee has done in years past.

But there is an added significance to the House hearings this session. Almost everything Congress is doing this summer, and will do next fall and winter, will be geared to next year's national elections. An avowed purpose of the domestic mining "bloc" in Congress this year is to build a case for stepped up Federal supports to U.S. mines to cite next year. Not only do mining-state Congressmen intend to make a record for more Government aid, but they also hope to pave the way for more trade protection, and stall any effort on the part of the Administration to unload surplus stockpiles (see below).

In addition to his hearings, Aspinall has introduced a new bill to provide import quotas on foreign lead and zinc when domestic prices fall below 15½c/lb and 13½c/lb levels.

On the Senate side, Chairman Murray has dropped similar legislation in the hopper as a tactical move toward winning Administration approval of new tariff boosts on lead and zinc.

Murray's Committee moved boldly last month to set a procedural precedent with its bill to set up import quotas on fluorspar patterned after the Sugar Act. By reporting the bill favorably to the floor, the Senate Interior Committee asserted its right to handle this kind of legislation, even though it affects U.S. trade (all trade legislation traditionally goes to the Senate Finance Committee). Under a compromise agreement, Chairman Harry Byrd (D-Va.) of the Finance Committee agreed to let Murray report the fluorspar import quota bill to the floor, and Murray agreed to having it

referred to Finance Committee for additional hearings. If Finance reports the bill favorably, it will give the measure new strength in the Senate. If not, it will likely be shelved.

On the House side, the Ways & Means Committee has rejected a similar compromise on a companion bill which Aspinall wants to report. The House Interior group has not yet received jurisdiction over the bill, and Ways & Means is demanding it be referred to that committee. In any event, passage of this bill is highly unlikely this session.

But the precedent its route through committees sets may have a telling effect on a similar bill now being drafted to cover aluminum imports. This also would pattern import quotas after the Sugar Act. There is industry disagreement, however, over how this bill should be worded, with the result it has not yet been introduced by Sen. Vance Hartke (D-Ind.) who has been working on it.

The red-hot issue of Government stockpile disposal policy has subsided a bit. Sen. Murray has introduced legislation which would put tighter "locks" on any Government disposal of surplus stocks, including those held in inventories now subject to Congressional approval before they can be sold. Murray, however, has agreed not to push this bill for the time being.

Office of Civil & Defense Mobilization, meanwhile, has similarly agreed to delay its bill to set up a national material reserve inventory of all surplus stocks, including those now in the strategic stockpile (E&MJ, June 1959, p. 24). This inventory could be sold with only Congressional notification, instead of approval, under the proposed Administration legislation.

This is a temporary truce, however, and sooner or later the issue will face a show-down.

Mining interests are reported to be dissatisfied with the Senate pre-merger notification bill that went to the Judiciary Committee for action last month. As amended by a Judiciary subcommittee, an exemption from pre-merger notification for mines which held 75% of their assets in undeveloped properties was stricken from the bill. The subcommittee kept intact an exemption for mines whose assets were 75% in partially developed properties, however.

A longer-range battle on Capitol Hill over tax policy is barely beginning to shape up. But it will evolve into a bitter dispute, and involve domestic mines deeply.

This is the controversy certain to be kicked off by Rep. Wilbur Mills in his announced House Ways & Means Committee hearings on tax reforms, including the touchy points of depreciation and percentage depletion allowances.

Hearings won't begin until next November, but they will also make important fodder for next year's election campaign. House committee staffers see the hearings aimed at reducing, rather than increasing, mining depreciation.

# Labor This Month

**"THEY HAVE GOTTEN AWAY WITH IT"—REUTHER:** The United Auto Workers president, Walter Reuther, has phrased the concern of union leaders over their future bargaining prospects. At a recent union conclave on bargaining the red-headed labor official conceded that management has the upper hand at the negotiating table. He says—and his associates agree—that employers have convinced the public that union wage raises are responsible for inflation. "They have gotten away with this concept that automatically higher wages means higher prices." Reuther, of course, disagrees with this theory, but anticipates that employer resistance, which has been so effective in nonferrous mining and steel, will continue in subsequent bargaining in railroads, rubber, aluminum and other industries still to go in 1959.

**LABOR'S COUNTER CAMPAIGN:** Union leaders are laying out strategy to offset their bargaining disadvantage. That's the purpose of the meeting of unions in the AFL-CIO industrial union department, representing some seven million workers. First, they'll hammer at the chicken-and-egg theme of prices and wages, and which came first. Their economists are busy detailing arguments that wage hikes haven't always brought price hikes—that because wages have gone up it doesn't mean prices have to go up. But, the unions are running smack into public opinion where the number one concern is inflation. Not only are the union negotiations facing management determination on the inflation-wage theory in bargaining, but they know many union members are in agreement with this concept. All this makes wage increases hard to sell where it counts most—in negotiations.

**THE SOFTENING-UP PROCESS:** With this public approach on wages and prices, labor chieftans are plotting a soft-sell to employers. The theme is that collective bargaining is breaking down. As Reuther puts it: "There is hardening of attitudes, a deterioration in the general relationship of labor and management." Reuther cites his own bargaining in the auto industry last year as the first indication of this stand. His union came out with a low-priced contract, even though its members stayed in the auto plants three months beyond the expiration of their contracts. He admits, "It was the most difficult year in the twenty-odd years of our collective bargaining experience."

Reuther's plan is a peace-making conference with management, where top officials for both sides would meet to discuss current issues affecting both—automation, shorter-workweek, welfare programs and the like. Bargaining would not enter the conferences—just the general topics of concern to both sides. The idea is that such high-level conferences would cut into the heavy atmosphere now surrounding negotiations. This plan you'll see promoted more and more in the future.

**SAME LABOR LAWS—NEW RULES:** While Congress is trying to write new Taft-Hartley and labor reform legislation, the old laws are bringing their own share of changes in labor-management rules. The National Labor Relations Board and the courts are coming up with new legal precedents—many of them in the areas now being considered by Congress. Take these key decisions:

- The U.S. Court of Appeals upholds the monitor system for the International Brotherhood of Teamsters. This legal test okays the plan whereby monitors—appointed by the court—have authority to clean-up the trucking union. The monitors were brought in on a suit by rank-and-file teamsters against president James R. Hoffa. This sets up a principle of union members suing their officers in court—an important part of the "bill of rights" proposal in current legislation before Congress.

- The unilateral wage hike rule is eased by the National Labor Relations Board. Employers have been barred from giving a wage raise over the head of the union in most circumstances. Now, the NLRB says an employer can grant an increase without notifying the union if he's convinced it no longer represents a majority of his workers. The hike can't be made for a full year after the union has been certified as bargaining agent. But, if he can show the union's loss or majority status after that, the fact that they have been negotiating won't bar a unilateral pay boost to the workers.

# MARKETS

## Copper Prices Ease; Shipments Heavy; Aluminum Shipments Up; Zinc Firm

NONFERROUS METAL PRICES were almost unchanged in June according to the E&MJ index. Lead and tin rose slightly and more than offset the drop in copper from 31.155c to 31.102c.

**Labor-management negotiations** were the major interest in the U.S. copper industry. Negotiations between Kennecott Copper and Mine-Mill were suspended. The union said the company did not make an offer. The union is reported seeking mediation. Kennecott officials said the firm could not make an offer until Mine-Mill indicated what it meant by "substantial" wage increases.

Labor negotiations for 14 properties owned by Asarco were suspended with Mine-Mill June 30. Asarco industrial relations director Douglas Soutar said: "there has been no meeting of minds." Union secretary-treasurer Albert Pezzati said the union would set the time of the next meeting early in July.

Many observers in the metal industries believe the unions in nonferrous metals intend having their membership work without contracts until the steel negotiations are settled. At that time, it is held, the steel contract provisions will be used as a base for serious negotiations in nonferrous industries. A lengthy strike in steel would unsettle such intentions and might lead to independent negotiations. Some analysts report copper mining firms are strongly opposed to concessions to the unions and that if the latter are adamant a strike is likely. Mine-Mill voted June 30 on granting its executive board authorization to call a strike.

**Copper prices eased** down in June. Custom smelters in the U.S. started the month at 32c delivered but in the last few days were selling at 30c. Producers stayed at 31½c. Merchants dropped their U.S. price from over 32c to about 29-¾c July 1. Katanga dropped from about 30.2c main European ports to 27.45c. The London Metal Exchange came down from about 30c for prompt to about 27.3c June 26; it recovered to 27.95c July 1.

The price weakness stemmed from the view that record copper production would not be interrupted by a prolonged strike and that any increase in demand would not be enough to prevent further accumulation by producers.

Copper sales reported to E&MJ for calculating weighted average prices continued at the high May rates both for the U.S. and abroad. May shipments of refined copper in the U.S. were 134,585 short tons, about unchanged from April. Deliveries outside the U.S. were 132,198 tons, down about 3,000. World crude primary production was at a record as was refined output outside the U.S. Copper fabricator data for the U.S. in May show shipments of fabricated products at 123,510 tons, up about 3,000 from April.

**Aluminum prices,** as distinct from quotations, are higher. Kaiser Aluminum early in June sent a letter to its customers which reads in part: "Effective July 1, 1959, Kaiser Aluminum is changing the transportation terms on shipment of aluminum products from 'f.o.b. shipping point,' to 'f.o.b. destination or customer custody.'" The letter continues " . . . it applies to all aluminum products except forgings, which will continue on the basis 'f.o.b. shipping point, no freight allowed.'" The new pricing policy, followed by the other primary aluminum producers, applies to pig and ingot as well as products.

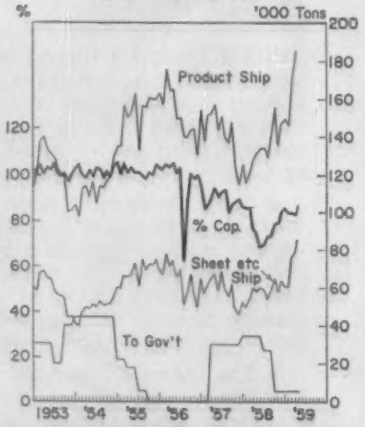
This statement was the first public move toward elimination of price discounts. A real delivered pricing system is being established in place of the freight allowed system. Reports are that in some cases freight was allowed of more than a cent over actual freight.

The new policy comes from improvement in business both owing to better consumption and prospects of further increases, and some strike hedge buying with metal accumulation at some fabricating plants. Aluminum Association data show sheet and foil shipments in May at a record high (see chart). Census data for wrought products show record shipments.

The new pricing policy may be a precursor to a general price increase following settlement of new labor contracts —most contracts terminate July 31.

D. H. Rhodes, president of Kaiser Aluminum, said aluminum price increases are inevitable this year if aluminum workers get wage increases. He also implied that even if wages do not rise price increases are possible. This is probably the first major aluminum producer that has made its position clear, at least publicly. Nearly everyone believes aluminum workers will get some increase. The major uncertainty is Alcan. There are indications it is opposed to raising prices. Nathanael V. Davis, president of Aluminium Ltd., in a recent speech, said price increases should come on fabricated products first. Alcan is a seller only of unfabricated metal in the U.S. and independent fabricators have complained about being squeezed between metal prices and product prices.

**U.S Aluminum**




The heavy line and the left hand scale show the % of primary capacity at which the industry is operating. Product shipments (Census Bureau data) are the total tonnage of aluminum fabricated products and castings shipped—these products are made from primary, secondary and imported metal. "Sheet etc shipments" are Aluminum Association data for sheet and foil for regularly reporting companies. All data through May except product shipments through April.

Alcoa and Imperial Chemical Industries, Ltd., have joined to form Imperial Aluminium Co. Ltd. ICI is a highly diversified U.K. chemical and metal producing and fabricating firm—it sells $2-billion of goods annually. The new firm, owned 51% by ICI and 49% by Alcoa will operate ICI's rolling and extrusion plant in South Wales (about 25,000 tons capacity). In the official statements in the U.S. nothing was said about expanding this capacity—but reports are that expansion was suggested in the U.K. statement. In neither location was it indicated what Alcoa paid for the 49%. In the U.K. it was said the new company could buy aluminum from whomever it wished. In the U.S. no statement of this sort appeared and spokesmen implied Alcoa, which had not been a supplier of aluminum (Alcan had been getting most of this business) would supply pig and ingot. Possibly this will have to wait until term contracts with other suppliers end. Alcoa, in addition to getting another outlet for metal, is joining an organization with world-wide sales outlets for fabricated products.

**Lead sales in June,** reported to E&MJ for calculating weighted average prices, were low. This reflected the exceptionally heavy sales in April and May rather than a drop in consumption. American Bureau of Metal Statistics show May shipments in the U.S. the highest since WW II.

Secretary of the Interior Seaton said late in June that Interior is considering import quotas for lead and zinc products. Spokesmen for lead and zinc mining companies at hearings held by the House interior subcommittee on mining said lead and zinc mining firms in the U.S. should receive greater aid

**Zinc sales** reported to E&MJ in June were exceptionally high though under May. The heavy sales reflect in part forward buying in anticipation of price increases. Most sellers say such increases would have come earlier except for the belief there would be a steel strike and a cessation of buying. If prices were then to fall zinc concentrate buyers would have taken in concentrates at prices higher than they could realize on their sales. American Zinc Institute data for May show shipments of Prime Western and Special High up from April. Total zinc metal stocks dropped 8,000 tons.

## Average Prices June (E&MJ Quotations)

| | |
|---|---|
| **Copper:** | |
| Electro, domestic refinery | 31.102 |
| Electrolytic, export refinery | 28.114 |
| Electrolytic, c.i.f. Cont'l ports | 29.059 |
| **Lead:** | |
| Common, New York | 12.000 |
| Common, St. Louis | 11.800 |
| **Silver:** | |
| Silver, New York, per oz. | 91.375 |
| Silver, London, pence per oz. | 78.330 |
| **Zinc:** | |
| Prime, Western, East St. Louis | 11.000 |
| Prime, Western, delivered (g) | 11.500 |
| **Tin:** | |
| New York Straits | 104.250 |
| **Gold,** per oz., U. S. price | $35.000 |
| Sterling Exchange | 281.254 |
| **Quicksilver,** per flask | $240.273 |
| **Antimony** (E&MJ) (d) | 32.590 |
| **Antimony,** bulk, Laredo | 29.000 |
| **Antimony,** in cases, Laredo | 29.500 |
| **Platinum,** refined, per oz. | $77.000 |
| **Cadmium** (a) | 120.000 |
| **Cadmium** (b) | 130.000 |
| **Al., 99½** dom., ingot | 26.800 |
| export, pag. | 22.500 |
| **Magnesium, ingot** | 35.250 |
| **Nickel** (f) | 74.000 |

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Per lb. delivered, ton lots.
(b) Per lb. delivered, small lots.
(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(f) Contract price, f.o.b. Port Colborne U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

## Free Gold Market

June saw a slight rise of 7½% in the volume of international gold dealings, with largest turnover in Paris followed by London. Bar gold prices remained practically unchanged in Europe while coins eased somewhat. No Soviet sales occurred. U.S. gold losses continued. Some Red Chinese gold purchases were reported from Hong Kong. Brisk activity was evident in Indonesia and the Philippines on monetary troubles. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

| | COINS | | BARS (12.5 kg) | |
|---|---|---|---|---|
| | May 31 | June 30 | May 31 | June 30 |
| NEW YORK | | | | |
| transit | | | $35.08½ | $35.08½ |
| MANILA | $42.10 | $42.00 | 36.15 | 36.20 |
| HONG KONG | 46.75 | 46.50 | 38.80 | 38.75 |
| BOMBAY | 64.00 | 63.00 | 63.50 | 62.50 |
| TANGIER | 40.60 | 40.75 | 35.25 | 35.25 |
| BEIRUT | 40.75 | 40.50 | 35.18 | 35.18½ |
| PARIS | 40.20 | 40.40 | 35.54 | 35.40 |
| BUENOS AIRES | 38.50 | 38.25 | 36.60 | 36.25 |

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

## Custom Smelter Copper Price

Based on flat price and E&MJ-average prices sales in U. S. for month of June reported by American Smelting & Refining Co.; electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

| | |
|---|---|
| Delivered Consumers' plant | 31.250 lb |
| F.o.b. refinery | 30.850 lb |

## Major Metals

### U. S. DAILY AND AVERAGE PRICES

| June 1959 | Electrolytic Copper (a) Domestic | (b) Export | Europe c.i.f. (c) | Lead New York | Lead St. Louis | Zinc (f) Delivered | Zinc East St. Louis | Aluminum Primary Pig 99% U. S. Dest. | Straits Tin New York |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 31.150 | 29.400 | 30.345 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.750 |
| 2 | 31.100 | 29.475 | 30.420 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.500 |
| 3 | 31.125 | 29.350 | 30.295 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.625 |
| 4 | 31.175 | 29.300 | 30.245 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.750 |
| 5 | 31.150 | 29.075 | 30.020 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.625 |
| 8 | 31.150 | 29.175 | 30.120 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.750 |
| 9 | 31.200 | 28.825 | 29.770 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 105.000 |
| 10 | 31.100 | 28.675 | 29.620 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.750 |
| 11 | 31.100 | 28.650 | 29.595 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.250 |
| 12 | 31.125 | 28.425 | 29.370 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.625 |
| 15 | 31.100 | 28.250 | 29.195 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.750 |
| 16 | 31.100 | 27.650 | 28.595 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.625 |
| 17 | 31.100 | 27.675 | 28.620 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.750 |
| 18 | 31.100 | 27.675 | 28.620 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.000 |
| 19 | 31.100 | 27.500 | 28.445 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.000 |
| 22 | 31.050 | 27.600 | 28.545 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.875 |
| 23 | 30.975 | 27.625 | 28.570 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.750 |
| 24 | 31.100 | 27.075 | 28.020 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.375 |
| 25 | 31.100 | 26.950 | 27.895 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.500 |
| 26 | 31.100 | 26.700 | 27.645 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.750 |
| 29 | 31.000 | 26.625 | 27.570 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.250 |
| 30 | 31.050 | 26.825 | 27.770 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.250 |
| **AVERAGES FOR MONTH** | | | | | | | | | |
| June | 31.102 | 28.114 | 29.059 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.250 |
| **AVERAGES FOR WEEK** | | | | | | | | | |
| June | | | | | | | | | |
| 3 | 31.115 | 29.435 | 30.380 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.250 |
| 10 | 31.155 | 29.010 | 29.955 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.775 |
| 17 | 31.105 | 28.130 | 29.075 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.600 |
| 24 | 31.065 | 27.495 | 28.440 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.800 |
| **CALENDAR WEEK AVERAGES** | | | | | | | | | |
| June | | | | | | | | | |
| 5 | 31.140 | 29.320 | 30.265 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.650 |
| 12 | 31.135 | 28.750 | 29.695 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.675 |
| 19 | 31.100 | 27.750 | 28.695 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 104.425 |
| 26 | 31.065 | 27.190 | 28.135 | 12.000 | 11.800 | 11.500 | 11.000 | 24.700 | 103.650 |

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.0400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

## Silver, Gold and Sterling

### DAILY AND AVERAGE PRICES

| June 1959 | Silver (c) New York | Silver London | Sterling Exchange | Gold (d) London |
|---|---|---|---|---|
| 1 | 91.375 | 78.500d. | 281.2000 | 249s. 8¼d. |
| 2 | 91.375 | 78.500d. | 281.2200 | 249s. 8¼d. |
| 3 | 91.375 | 78.500d. | 281.2900 | 249s. 8d. |
| 4 | 91.375 | 78.500d. | 281.3000 | 249s. 8d. |
| 5 | 91.375 | 78.500d. | 281.2200 | 249s. 8¼d. |
| 8 | 91.375 | 78.500d. | 281.2200 | 249s. 9d. |
| 9 | 91.375 | 78.500d. | 281.1600 | 249s. 9¼d. |
| 10 | 91.375 | 78.250d. | 281.1200 | 249s. 10d. |
| 11 | 91.375 | 78.250d. | 281.1200 | 249s. 9¾d. |
| 12 | 91.375 | 78.250d. | 281.2100 | 249s. 9¼d. |
| 15 | 91.375 | 78.250d. | 281.2400 | 249s. 8¾d. |
| 16 | 91.375 | 78.250d. | 281.2200 | 249s. 8¾d. |
| 17 | 91.375 | 78.250d. | 281.2300 | 249s. 9d. |
| 18 | 91.375 | 78.250d. | 281.2900 | 249s. 8¼d. |
| 19 | 91.375 | 78.250d. | 281.3100 | 249s. 8¼d. |
| 22 | 91.375 | 78.250d. | 281.3000 | 249s. 8¼d. |
| 23 | 91.375 | 78.250d. | 281.2800 | 249s. 8¼d. |
| 24 | 91.375 | 78.250d. | 281.3200 | 249s. 7¾d. |
| 25 | 91.375 | 78.250d. | 281.3500 | 249s. 6¾d. |
| 26 | 91.375 | 78.250d. | 281.3400 | 249s. 6¾d. |
| 29 | 91.375 | 78.250d. | 281.3300 | 249s. 7d. |
| 30 | 91.375 | 78.250d. | 281.3100 | 249s. 7¼d. |
| **AVERAGES FOR MONTH** | | | | |
| June | 91.375 | 78.330d. | 281.254 | — |
| **AVERAGES FOR WEEK** | | | | |
| June | | | | |
| 3 | 91.375 | — | 281.202 | — |
| 10 | 91.375 | — | 281.204 | — |
| 17 | 91.375 | — | 281.204 | — |
| 24 | 91.375 | — | 281.300 | — |

Calendar Week Averages: New York Silver: June 5, 91.375; June 12, 91.375; June 19, 91.375; June 26, 91.375.

# MARKETS *(Continued)*

## London Metal Exchange Quotations

| June | COPPER Cash Bid | COPPER Cash Asked | COPPER 3 Mo. Bid | COPPER 3 Mo. Asked | LEAD Current Month Bid | LEAD Current Month Asked | LEAD 3 Mo. Bid | LEAD 3 Mo. Asked | ZINC Current Month Bid | ZINC Current Month Asked | ZINC 3 Mo. Bid | ZINC 3 Mo. Asked | TIN Cash Bid | TIN Cash Asked | TIN 3 Mo. Bid | TIN 3 Mo. Asked |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 240¾ | 241 | 240¼ | 240½ | 70¼ | 70½ | 71⅛ | 71⅜ | 77¾ | 78¼ | 76¾ | 77 | 785½ | 786 | 785½ | 786 |
| 2 | 242 | 242¼ | 241 | 241¼ | 70⅛ | 70⅜ | 71⅛ | 71⅜ | 78¼ | 78⅝ | 77⅛ | 77⅛ | 785½ | 786 | 786 | 786½ |
| 3 | 239 | 239¼ | 238½ | 238¾ | 70 | 70¼ | 71¼ | 71½ | 77½ | 77¾ | 76½ | 76¾ | 787 | 787½ | 788 | 788½ |
| 4 | 240¼ | 240½ | 239 | 239¼ | 69¾ | 70 | 71⅜ | 71½ | 77½ | 77⅝ | 76¾ | 76⅞ | 787½ | 788 | 790 | 790½ |
| 5 | 237½ | 237½ | 236¼ | 236½ | 69½ | 70 | 71 | 71¼ | 77½ | 77½ | 76¼ | 76¾ | 786 | 786½ | 787½ | 788 |
| 8 | 238¾ | 239¼ | 237¾ | 238 | 69½ | 70 | 71¼ | 71½ | 77½ | 77¾ | 76¾ | 77 | 787 | 787½ | 788½ | 789 |
| 9 | 234¾ | 235 | 233½ | 233¾ | 69½ | 69¾ | 71 | 71¼ | 77½ | 77¾ | 76½ | 76½ | 788 | 789 | 790 | 790½ |
| 10 | 235½ | 235¾ | 234½ | 234¾ | 69¼ | 69¾ | 71 | 71¼ | 77½ | 77⅝ | 76¾ | 77 | 788½ | 789 | 790½ | 791½ |
| 11 | 234 | 234¼ | 233 | 233¼ | 68½ | 68¾ | 70⅝ | 70⅞ | 77 | 77¼ | 76½ | 76¾ | 786½ | 787 | 786½ | 787 |
| 12 | 231¾ | 232 | 231 | 231¼ | 69 | 69¼ | 71 | 71½ | 77⅛ | 77½ | 76¾ | 77 | 786½ | 788 | 787 | 788 |
| 15 | 230¾ | 231 | 230 | 230¼ | 68¾ | 69 | 70¾ | 71¼ | 77¼ | 77½ | 77 | 77½ | 788½ | 789 | 789½ | 790 |
| 16 | 226¼ | 226½ | 226 | 226¼ | 69½ | 69¾ | 71 | 71¼ | 77¾ | 78 | 77 | 77½ | 788½ | 789 | 789 | 789½ |
| 17 | 226 | 226¼ | 226 | 226½ | 70¼ | 70½ | 71½ | 71¾ | 78½ | 78⅝ | 77⅜ | 77½ | 788½ | 789½ | 789½ | 790 |
| 18 | 224¾ | 225 | 225¼ | 225½ | 69¾ | 70 | 71 | 71¼ | 78⅛ | 79 | 77⅝ | 77½ | 789½ | 790 | 790 | 790½ |
| 19 | 224 | 224½ | 225⅛ | 225¾ | 70⅜ | 70½ | 71⅞ | 72 | 79 | 79⅛ | 77⅝ | 77½ | 789 | 789½ | 789½ | 790½ |
| 22 | 226¼ | 226½ | 227¼ | 227½ | 70 | 70¾ | 71½ | 71¾ | 79 | 79½ | 77⅝ | 77¾ | 788 | 788½ | 789½ | 790 |
| 23 | 225¼ | 225½ | 226½ | 226¾ | 69¾ | 70 | 71½ | 71¾ | 79½ | 79⅝ | 77½ | 78 | 788 | 788½ | 789 | 789½ |
| 24 | 220½ | 220¾ | 221¾ | 222 | 69⅜ | 69½ | 71¼ | 71⅜ | 78¾ | 79¼ | 77 | 77½ | 788½ | 789 | 789½ | 790½ |
| 25 | 220½ | 220¾ | 221½ | 222 | 69¼ | 69⅝ | 71½ | 71⅝ | 79½ | 79¾ | 78¼ | 78½ | 790 | 791 | 791½ | 792 |
| 26 | 217½ | 217¾ | 218½ | 218¾ | 68¾ | 68⅞ | 70½ | 70¾ | 79¼ | 79½ | 78 | 78½ | 790 | 790½ | 791 | 791½ |
| 29 | 219½ | 219¾ | 220½ | 220¾ | 69 | 69¼ | 70⅝ | 71 | 80 | 80½ | 78½ | 78¾ | 790½ | 791 | 791½ | 792 |
| 30 | 222¾ | 223 | 223¾ | 224 | 69¾ | 69⅞ | 71⅛ | 71⅜ | 80 | 80½ | 78¾ | 78⅞ | 790½ | 791½ | 792 | 793 |
| Av'g's | £230.045 | | £230.017 | | £69.668 | | £71.281 | | £78.409 | | £77.347 | | £788.386 | | £789.443 | |

Prices are for the official a.m. session in pounds sterling per ton of 2240lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

## Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

### MISCELLANEOUS METALS

June 30, 1959

| | | |
|---|---|---|
| Aluminum ingot, 99 plus % lb. | | 26.8¢ |
| Antimony, spot, lb., less than carload, in cases | | 32.59¢ |
| In bulk, carload lots, f.o.b. Laredo | | 29.00¢ |
| Imported, 10 ton min. (p), 99½% | | 24¢ |
| Bismuth, ton lots, lb. | | $2.25 |
| Cadmium, small lots, commercial sticks, delivered, lb. | | $1.20 |
| small lots | | $1.30 |
| Calcium, lb., ton lots, 98%, cast | | $2.05 |
| Chromium, 97% grade, lb., contract del. | | $1.29 |
| Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957 | | $1.75 |
| Germanium, per gram, 10,000 gram lots | (d) 33¢ @(c) | (d)35¢ |
| Indium, troy oz. | $1.25 @ | $2.25 |
| Lithium, lb., 98% | $9.00 @ | $11.00 |
| Nickel, cathodes, lb. (a) | | 74¢ |
| Other sales, reg. sellers | | 74¢ |
| Sales by dealers, etc. | | 74¢ |
| Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16 | | 35¼¢ |
| Palladium, troy oz. | $18.00 @ | $20.00 |
| Platinum (wholesale lots), troy oz. | $76 @ | $80 |
| Quicksilver flask of 76 lb. 25 flasks or more | $238 @ | $240 |
| Selenium, 99 plus %, lb.—(Feb. 19, 1958) | | $7.00 |
| Silicon, minimum 97%, carloads, lb. | | 21¼¢ |
| Semi Conductor grade, lb. | | $350 |
| Tellurium, lb. | | $2 |
| Thallium, 100 lb. or more lb. | | $7.50 |
| Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b) | $1.62 @ | $1.82 |

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958. (c) Delivered; (d) f.o.b. plant.

### METALLIC ORES

| | | |
|---|---|---|
| Beryllium Ore, imported, 10% BeO, (b) stu: spot | | $30 |
| term contracts | $31 — | $32.25 |
| Chrome Ore per long ton, f.o.b. cars Atl. ports, dry: | | |
| 44% $Cr_2O_3$ no ratio | $18 @ | $19 |
| 48% $Cr_2O_3$ 3 to 1 ratio | $35 @ | $39½ |
| Iron Ore, Lake Superior, Lower Lake ports, long ton: | | |
| Old Range bessemer | | $11.85(e) |
| Mesabi bessemer | | $11.60(e) |
| Mesabi non bessemer | | $11.45(e) |
| Lead (Galena), 80%, Joplin, Mo., ton | | $141.72 |

Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra. 87¢—90¢. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.

| | | |
|---|---|---|
| Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines | | $1.25 |
| Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio | $1.10 @ | $1.15 |
| Tungsten Ore, per stu of $WO_3$: | | |
| Foreign 60%, c.i.f. U. S. ports, duty extra | | $12.50–$13.00 |
| U. S. scheelite, f.o.b. mill | $20½ @ | (a)$22 |
| Vanadium Ore, per lb. of contained $V_2O_5$ f.o.b. mines | | 31¢ |
| Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton. | | $64 |

(a) Nominal. (b) c.i.f. U. S. ports. (c) Eff. 1958 shipping season.

### METALLIC COMPOUNDS

| | | |
|---|---|---|
| Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots N. Y. docks | | 4–5¢ |
| Cobalt Oxide, 72¼% to 73¼%, per lb. eff. Dec. 1, '56 | $1.33 @ | $1.36 |
| Copper Sulphate, 100 lb. eff. Oct. 24, '58 | | $12.30 |
| Germanium Dioxide, gm. | | 18½¢ |
| Molybdic trioxide, technical, per lb. of Mo | $1.46 @ | $1.47 |
| Imported, incl. 37¢ duty | $1.75 @ | $2.05 |

### ALLOYS

| | | |
|---|---|---|
| Ferrochrome 65 to 70%, per lb. of Cr, (4-9% C) | | 28¼¢ |
| Ferromanganese, 74 to 76%, per lb., shipg. pt. | | 12¼¢ |
| Ferromolybdenum, 58 to 64% Mo lb. of Mo contained | $1.50 @ | $1.82 |
| Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957) | | 14.60¢ |
| Ferrotungsten, 72 to 82%, lb. of W contained | | $2.15 |
| Ferrovanadium, per lb. of V delivered | $3.20 @ | $3.40 |
| Silicomanganese, max. 1½% carbon, lb. contracts | | 12.8¢ |
| Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7 | | $102.50 |

### NON-METALLIC MINERALS

| | | |
|---|---|---|
| Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton: | | |
| Crude No. 1 | $1,400 @ | $1,810 |
| Crude No. 2 | $750 @ | $1,155 |
| Spinning fibers | $370 @ | $600 |
| Shingle fibers | $180 @ | $220 |
| Paper stock | $120 @ | $145 |
| Waste | $75 @ | $86 |
| Shorts | $40 @ | $75 |
| Asbestos, f.o.b., Vancouver, B. C. (Canadian funds): | | |
| Crude No. 1 | | $1,522 |
| Spinning fibers | $220 @ | $787 |
| Asbestos, Vermont, f.o.b. Morrisville: | | |
| Spinning fibers | $370 @ | $428 |
| Shingle stock | $181 @ | $200 |
| Paper stock | $120 @ | $152 |
| Waste, stucco or plaster | | $86 |
| Refuse or Shorts | $41 @ | $75 |
| Barytes f.o.b. cars: | | |
| Georgia, crude, per ton | | $18 |
| Missouri, 94%, BaSO, per short ton | $16 @ | $18 |
| Crude oil well grade, min. 4.3% sp. gravity, st (a) | | $18 |
| Imported, c.i.f. Gulf Ports, st | $16 @ | $18 |
| Bauxite, long ton, f.o.b. point of shipment: | | |
| Domestic, crude, 50 to 52% (not dried) | (c)$ 5.00 @ | $5.50 |
| Domestic, chemical, 55 to 58% | (c)$ 8.00 @ | $8.50 |
| Domestic, abrasive, 86 to 84% | (c)$18.00 @ | $18.50 |
| Imported metallurgical, per lt. f.o.b. Br. Guiana, dep. on grade | | $7.14 |
| Feldspar, bulk ton: | | |
| Potash or soda feldspar, 200 mesh, ceramic grade | | $20.50–$21 |
| Glass feldspar, white, 20 mesh | | $9 |
| Fluorspar, f.o.b. mines, bulk, 72½% effective, ton | $37 @ | $41 |
| 60% effective $CaF_2$ | $33 @ | $36.50 |
| Acid 97% concentrate, bulk, ton (eff. 12–1–56) | | $50.00 |
| Fuller's earth, f.o.b. Georgia or Florida, ton | $7.00 @ | $14.00 |
| Magnesite, per ton dead-burned, bulk, f.o.b. Washington | | $46 |

Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; x 2 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap $20 @ $30.

| | | |
|---|---|---|
| Ocher, Georgia, ton in sacks | $26.50 @ | $32.00 |
| Purites, Spanish, per long ton unit of S. c.i.f. atlantic ports | | Not quoted |
| Sulphur, per lt. f.o.b. U. S. mines: bright | | $23.50 |
| dark | | $22.50 |
| Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use | $22.40 @ | $31.60 |
| For export f.o.b. vessel, lt. dep. on grade | $22 @ | $24 |
| Talc, f.o.b. works, ton: | | |
| New York, purified | $18.00 @ | $20.00 |
| Vermont, extra fine | | $12.50 |
| Tripoli, Missouri, ton: | | |
| 40-mesh, cream colored | | $50.00 |

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

### IRON AND STEEL

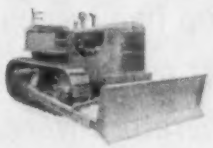
| | | |
|---|---|---|
| Pig Iron, gross ton, basic, Valley Furnaces | | $66.00 |
| Steel, f.o.b. Pittsburgh, billets, net ton | | $80.00 |
| Structural shapes, Pa., Ala., etc. 100 lb. | $5.30 @ | $5.50 |

metal mining modernization

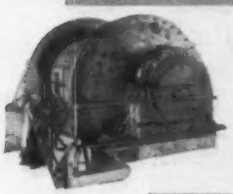
# Allis-Chalmers wraps up your complete Processing Package

**Earth-moving machines, processing machinery, electrical equipment "Coordineered" from plan to plant**

HELP FOR YOU OR YOUR CONSULTANTS



EXPERT EVALUATION OF YOUR REQUIREMENTS



INTEGRATED THINKING, PLANNING, ENGINEERING

COMPLETE LABORATORY AND PILOT PLANT FACILITIES

EQUIPMENT MATCHED FOR TOP EFFICIENCY

UNDIVIDED RESPONSIBILITY FOR PERFORMANCE

MAINTENANCE CHECKUPS, FAST PARTS SERVICE

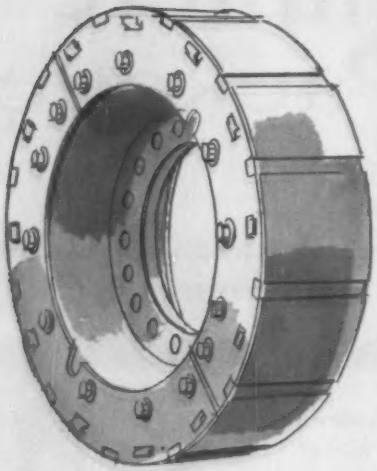
**Send for Bulletin 07B7995**

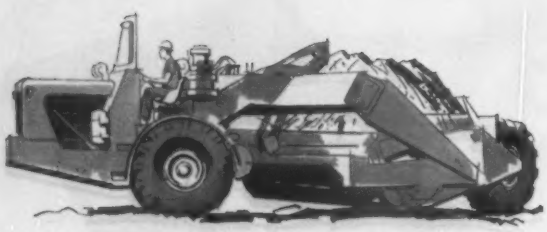
*Handy reference offers only scientific method of determining right crusher or grinding mill and required horsepower. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wis. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Que.*

A-5932

B.F.Goodrich

# Why the switch to B. F. Goodrich Hi-Torque Brakes?





Because they are the only brakes with the reserve power to handle those giant wheeled vehicles now in production and those still on the drawing boards! Full circle stopping power provides uniform lining pressure, resists fade. In fact, B. F. Goodrich Hi-Torque Brakes stop heavy equipment up to twice as fast as conventional two-shoe brakes. Operators work faster—with greater safety—even on terrain usually considered unsafe. Join the big switch now. Specify Hi-Torque for your heavy duty off-highway equipment. B. F. Goodrich Hi-Torque Brakes are available in sizes from 17¼″ x 4″ to 26″ x 7″. They require only one hydraulic connection—need no lubrication—and adjust themselves automatically. Get the whole story. Contact: B. F. Goodrich Aviation Products, a division of The B. F. Goodrich Company, Dept. EM-79, Troy, Ohio.

**B.F.Goodrich *Hi-Torque brakes***

metal mining modernization

# New ROM screen shakes off brutal battering

**Designed to team up with primary crushers to handle toughest jobs in any metal mining flow**

**There's an Allis-Chalmers screen for every metal mining application**

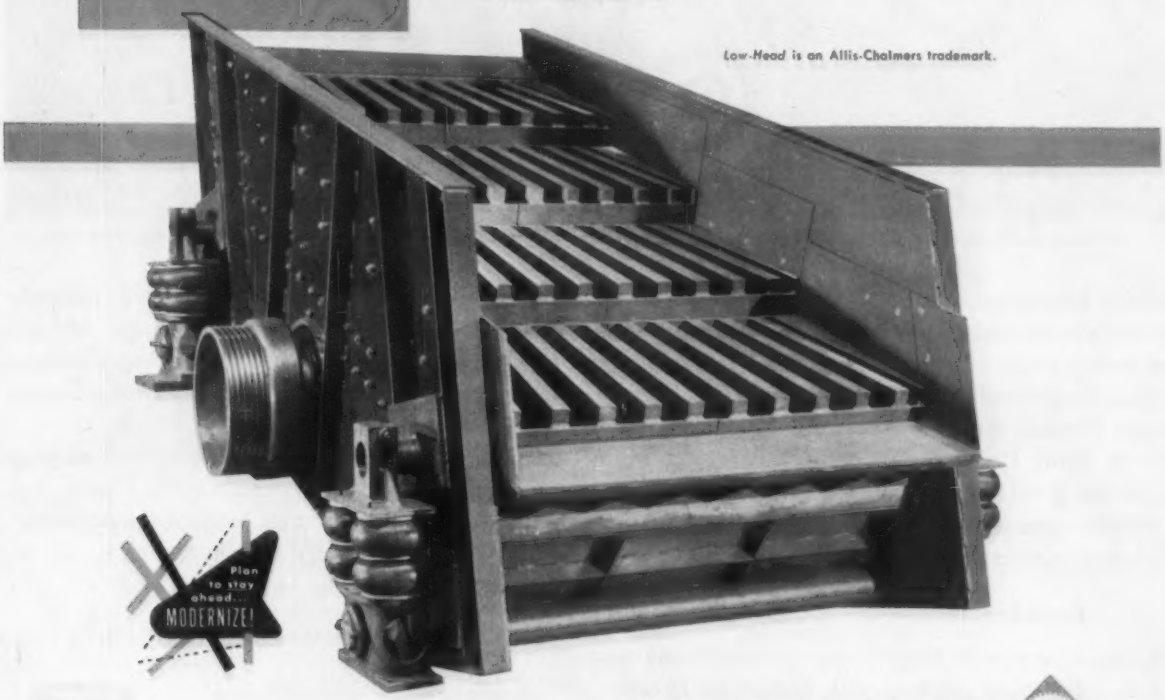
A complete line of inclined screens for scalping, sizing and cyclone plant application; plus the industry's most popular screen — the Low-Head horizontal screen for pre-wetting, washing and sizing, media recovery.

Large volume requirements . . . single pieces of ore weighing as much as four tons . . . such are the demanding conditions under which this screen is setting new performance standards.

Built for heavy-duty service, its husky support frame ignores persistent pounding. Its giant bearings are designed for long life. And even if hundreds of pounds of sticky material cling to its body, this *extra heavy duty* screen still performs efficiently. Vibration isolation is handled effectively by either air springs or steel coil springs.

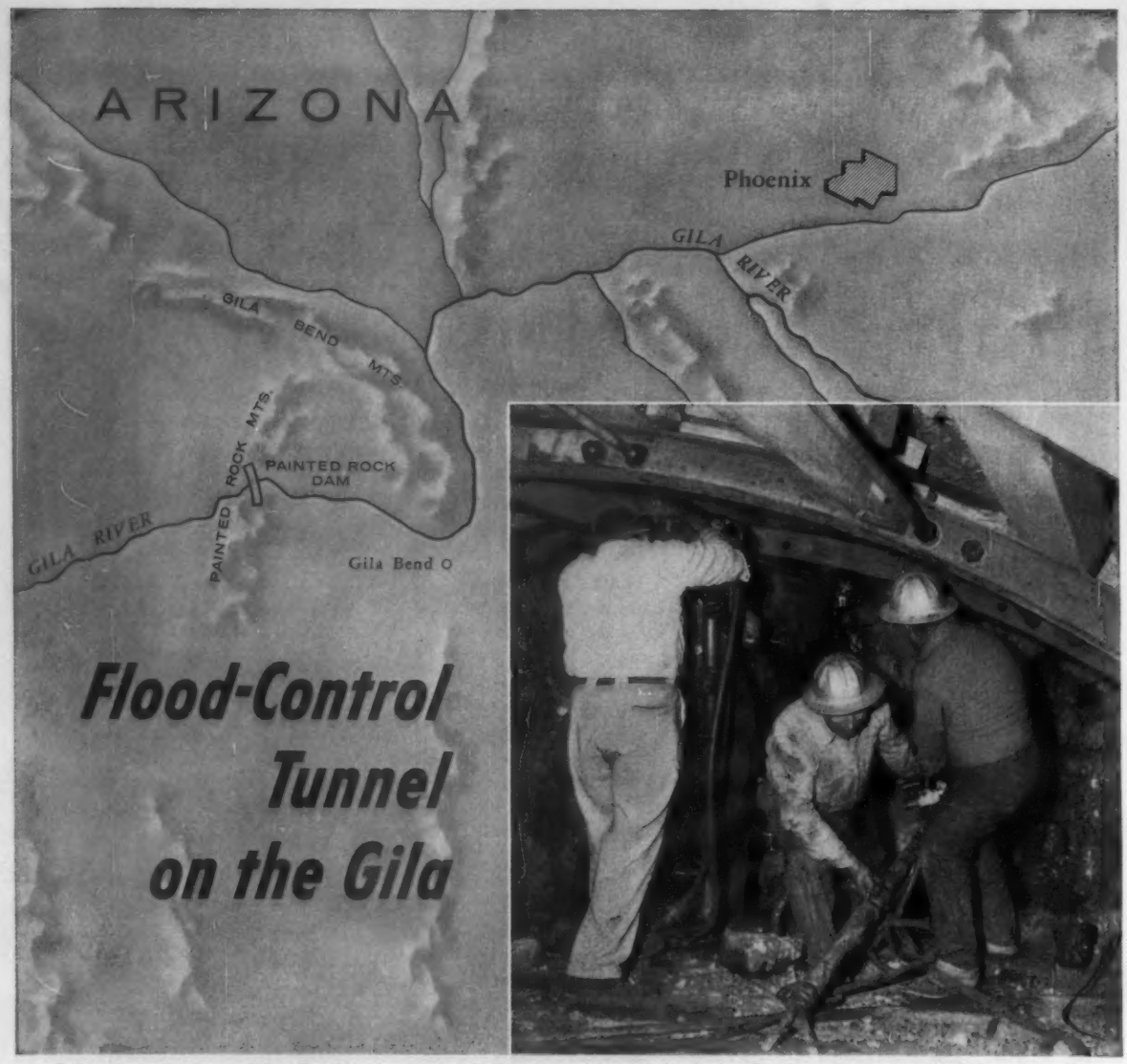
*For complete information, see your Allis-Chalmers representative or write for Bulletin 07B8368, Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.*

Low-Head is an Allis-Chalmers trademark.




**ALLIS-CHALMERS**

A-5941-MM




# Flood-Control Tunnel on the Gila

Drill steel supplier: Brunner & Lay Co. of Los Angeles, Inc.; Drill steel reconditioner: D. W. Jaquay Co.; General contractor: Mittry Construction Co.

Using Bethlehem Hollow Drill Steel, this crew is drilling a blasting pattern for a 975-ft long, 25-ft diameter outlet tunnel, which is part of the Painted Rock Dam Flood Control Project on the Gila River, near Phoenix, Arizona. Under the direction of the U. S. Army Corps of Engineers, this project will provide protection against flash floods for some 300,000 acres of irrigated farm land, and will have a net storage capacity of 2,291,700 acre-feet.

### *Bethlehem Hollow Drill is Economical*

In any type of rock removal job, you can count on economical blast patterns with Bethlehem Hollow Drill. Tough and fatigue-resistant, it has a uniformly round hole, and a wide quenching range. And it's easy to heat-treat so that you get the proper balance of toughness and wear-resistance for strong threads and shanks.

Be sure to specify Bethlehem Hollow for all your rock drilling work. You can obtain it in Carbon and Ultra-Alloy grades in rounds, hexagons, and quarter-octagons, and in lengths from 18 ft to 27 ft. Longer lengths can also be supplied.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

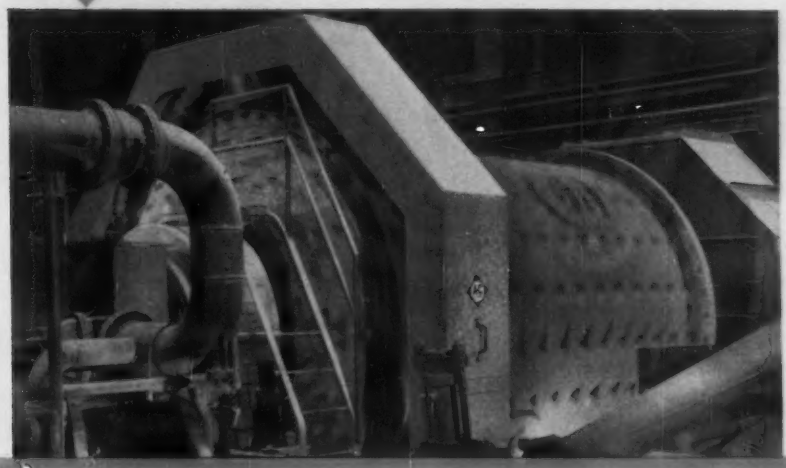
Export Distributor: Bethlehem Steel Export Corporation

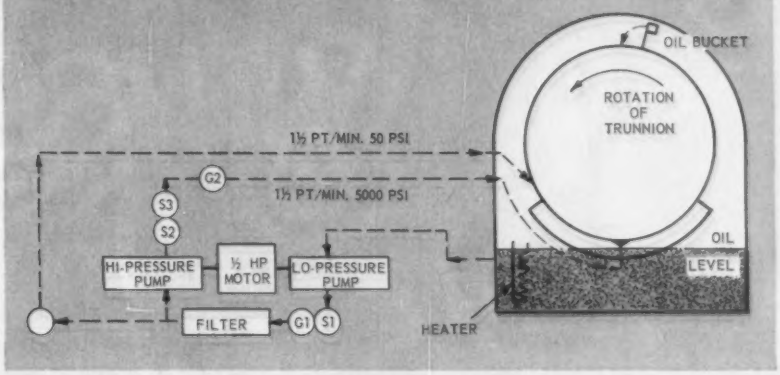
**BETHLEHEM STEEL**

BETHLEHEM STEEL

A-C ALLIS-CHALMERS

metal mining modernization






# Floating start, ride and stop for big mills

**New Lubritrol system provides constant lubrication for trunnion bearings**

Volume producers throughout the metallic mining industry are taking advantage of the cost-cutting, space-saving advantages of big grinding mills. When *you* modernize with a bigger mill insist on Allis-Chalmers — the only mill that gives you the positive protection and maintenance economy of *Lubritrol* constant lubrication. These new and bigger mills actually *float on oil.* No bearing-wearing starts. Less wasted horsepower. All functions of the *Lubritrol* system are automatic . . . controlled by foolproof pressure gages and switches.

There's an expert in your nearby A-C office ready and willing to help. Or drop a line to Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

*Lubritrol* is an Allis-Chalmers trademark.

**ALLIS-CHALMERS** A-C

A-5934

# STAY OUT OF THE MUCK

**NOW—Dust-free drilling without water!**

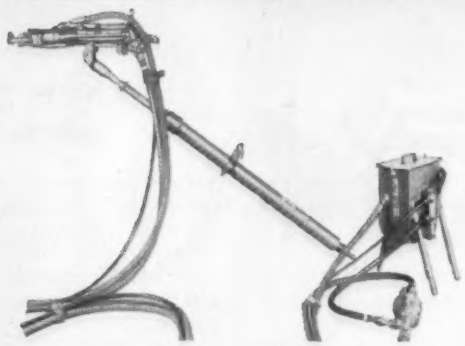
*...with the Le Roi LLV Dust-collecting Air Leg Drill*

You'll drill fast, dry, and clean through the hardest rock with the new Le Roi LLV Dust-collecting Air Leg Drill. It outperforms wet-drilling machines and has a much lower dust count — you don't use a drop of water in the mine or tunnel.

The LLV's efficient dust collection keeps holes clean for faster, deeper penetration — prevents stuck steels and lost holes. Its powerful suction removes cuttings through the hollow drill steel and out the side of the chuck housing. *None* passes through the machine. Results: less maintenance and longer tool life.

What's more, dry cuttings permit continuous ore sampling — and all can be reclaimed!

Ask your Le Roi distributor for a demonstration. Or write Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.



*DRY "DUSTLESS" LLV collects cuttings in LX-1 dust box. Operator can empty box by remote control lever on drill.*

## LE ROI NEWMATIC® AIR TOOLS

PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-908

metal mining modernization

# 2-YEAR ACID TEST!
## Open motor beats enclosed type at its own game

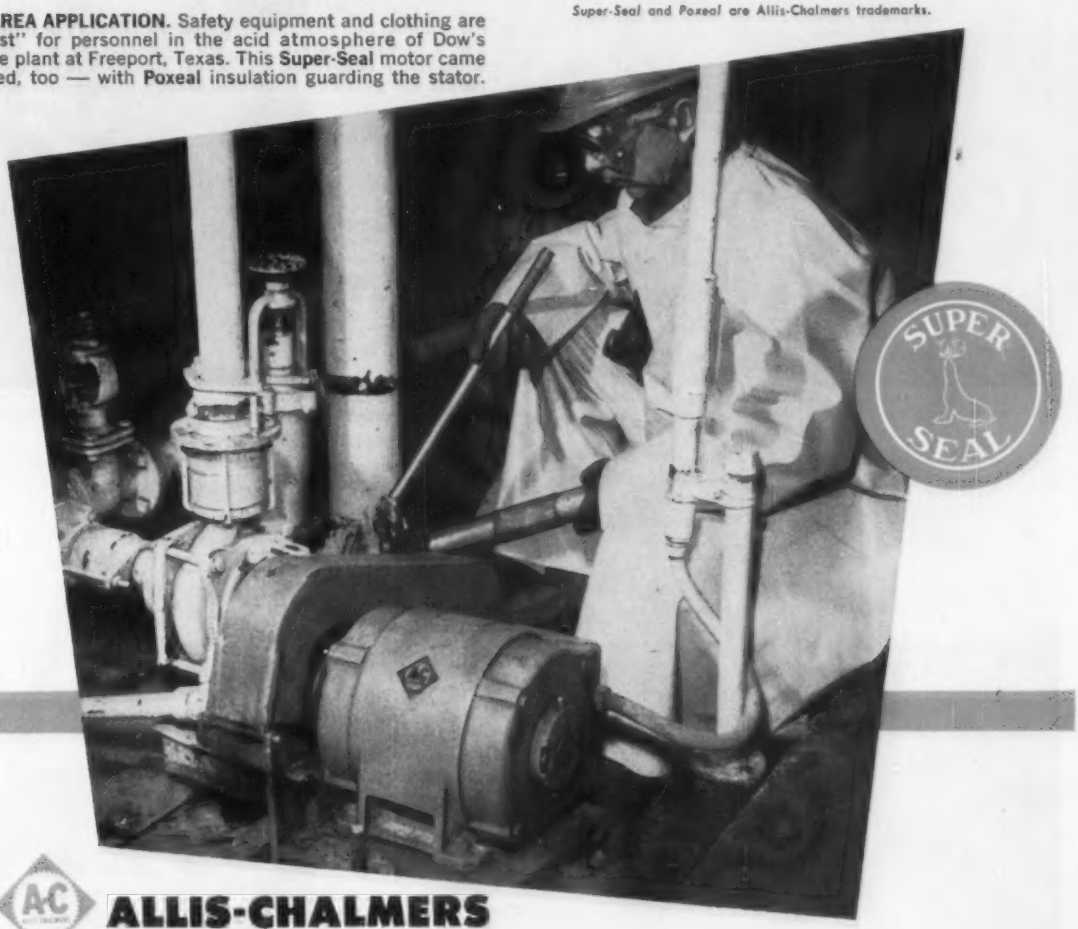
**In a tough acid pump installation,** Dow Chemical's Texas Division experienced no end of motor troubles. It seemed nothing could stand up in that humid, corrosive atmosphere. Reports Dow: "Even with totally enclosed motors, winding failures were frequent." They might have added, expensive.

**Then came *Super-Seal* motors—** Allis-Chalmers open-type motors with amazing *Poxeal* insulation. A durable case of epoxy-resin encloses the winding end turns and slot portions of the stator . . . the most complete protection ever developed. Result? The *Super-Seal* motor, after two years of continuous operation in the acid area, is as good as ever. So good, in fact, that Dow has ordered 150 *Super-Seal* motors for a new chemical plant at Freeport, Texas.

**Isn't it time** to revaluate *your* motor standards? There's a good chance that costly enclosed motors are no longer needed. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

*Super-Seal and Poxeal are Allis-Chalmers trademarks.*

**ACID AREA APPLICATION.** Safety equipment and clothing are a "must" for personnel in the acid atmosphere of Dow's chlorine plant at Freeport, Texas. This **Super-Seal** motor came prepared, too — with **Poxeal** insulation guarding the stator.

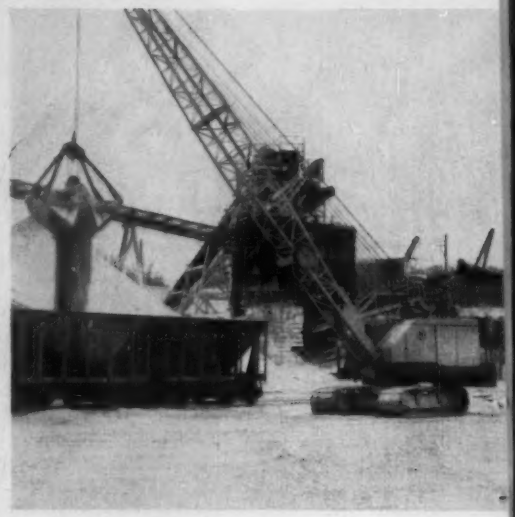



**ALLIS-CHALMERS**

A-1036-MM

# KOEHRING WORK CAPACITY *in action* . . .

**A heavy-duty team —**
Owner of this limestone quarry has standardized on Koehring® equipment for both excavating *and* hauling. Blasted rock is loaded out by 1-yard 405 shovel —and hauled to crusher in 6-yd. Koehring Dumptors.

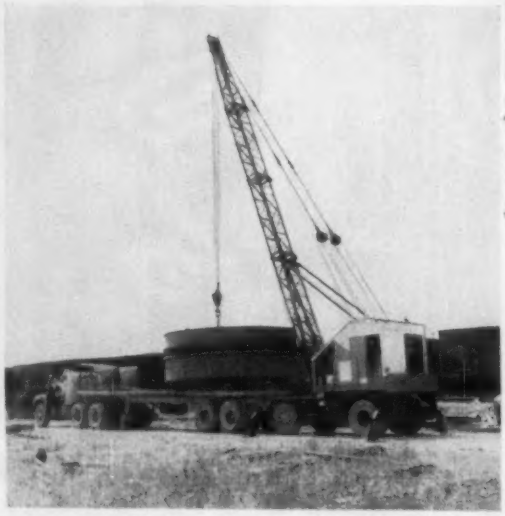


**Loading RR cars —**
stockpiling, lifting 22-ton crusher into place, erecting plant, feeding hoppers in the pit — busy Koehring 805 is a jack-of-all-trades around this gravel plant. Capacities: 2 to 3-yard clamshell or dragline, 52-ton lift crane — converts to 2-yard shovel.

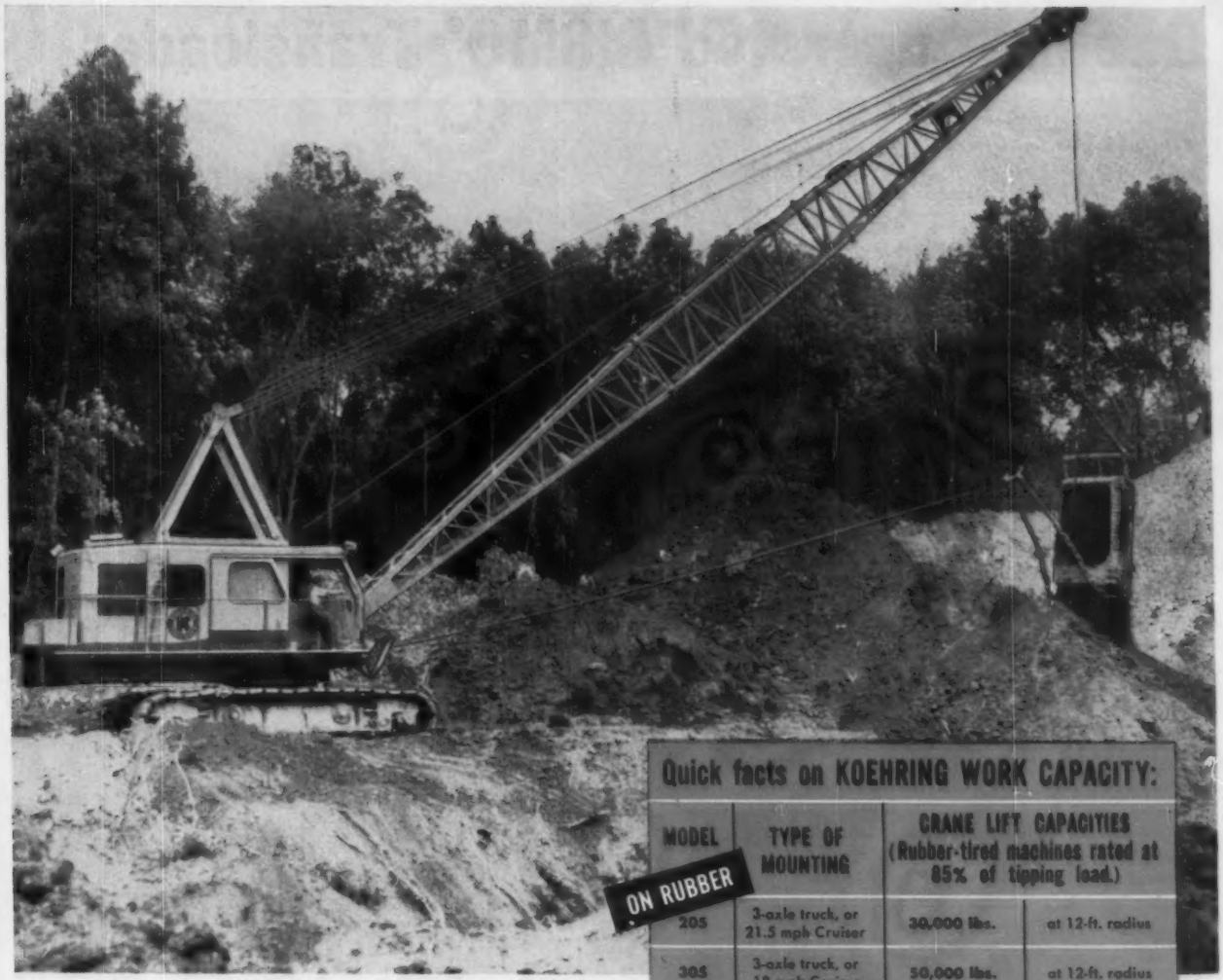
**Rock-buster —**
Swinging a skull-cracker in stone quarry, a 15-ton 305 crane pulverizes oversize slabs and chunks of blasted rock. A popular size in mines, quarries, the 305 is available on 3 types of mountings: crawlers, truck, self-propelled Cruiser®.

**High-lift stripper —**
at this coal mine has 1½ yd. dipper on 28-ft. high-lift boom. Work range: 34 ft.-4 in. cutting height and 25-ft.-9 in. dumping height at 45° boom angle. It's a Koehring 605. Also available with 1½-yd. dipper on standard 22-ft. heavy-rock shovel boom.

**New tool, new method**
speeds digging, loading. Cycle: 7-ft. independent crowd—then swing, dump, and swing back to digging position *with no traveling!* See this 2-yard 205 SKOOPER in action. Check how many tons it moves per hour with only 70 hp!



**Unloading machinery**
for power plant, one-man-operated 205 Cruiser easily handles heavy loads. Lifts up to 15 tons, has 21.5 mph travel speed — *plus* clamshell - dragline - shovel - hoe convertibility.



**Stripping 30 feet** of overburden from coal deposits, Koehring 1205 dragline swings big bucket over a wide work radius. Bucket sizes on the big 1205 range from 3 to 4 yards — and boom lengths from 60 to 170 feet, depending on weight of materials. Yet, operator handles it with light lever-pull (90% power-assist on main drum clutches). Retains sensitive "feel" of load. 360° full-revolving fairlead maintains true cable lead at any pull angle on bucket. 1205 converts to clamshell, 95-ton crane, 3-yard shovel (standard or high-lift). Call your Koehring distributor for complete details on this, and all other sizes.

## Quick facts on KOEHRING WORK CAPACITY:

| | MODEL | TYPE OF MOUNTING | CRANE LIFT CAPACITIES (Rubber-tired machines rated at 85% of tipping load.) | |
|---|---|---|---|---|
| ON RUBBER | 205 | 3-axle truck, or 21.5 mph Cruiser | 30,000 lbs. | at 12-ft. radius |
| | 305 | 3-axle truck, or 18 mph Cruiser | 50,000 lbs. | at 12-ft. radius |
| | 330 | 3-axle truck | 60,000 lbs. | at 15-ft. radius |
| | 435 | 4-axle truck | 70,000 lbs. | at 15-ft. radius |
| | 545 | 4-axle truck | 90,000 lbs. | at 15-ft. radius |
| ON CRAWLERS | | Size shovel | CRANE LIFT CAPACITIES (Crawler ratings based on 75% of tipping load.) | |
| | 205 | ½ Cu. Yd. | 20,000 lbs. | at 10-ft. radius |
| | 305 | ¾ Cu. Yd. | 30,000 lbs. | at 12-ft. radius |
| | 405 | 1 Cu. Yd. | 40,000 lbs. | at 12-ft. radius |
| | 545 | (Crane only — 85% rating) | 90,000 lbs. | at 12-ft. radius |
| | 605 | 1½ Cu. Yds. | 72,300 lbs. | at 12-ft. radius |
| | 805 | 2 Cu. Yds. | 104,200 lbs. | at 12-ft. radius |
| | 1205 | 3 Cu. Yds. | 190,000 lbs. | at 12-ft. radius |

*Extra lift capacity means . . .* MORE WORK CAPACITY WITH ALL ATTACHMENTS

K932

**KOEHRING**
**DIVISION OF KOEHRING COMPANY**
**Milwaukee 16, Wisconsin**

*Koehring excavators, cranes also manufactured in:* ENGLAND • SPAIN • JAPAN

*In Canada:* KOEHRING-WATEROUS LTD. Brantford, Ontario

# One man operated GISMO® Transloader

- . . . with round-trip travel 1,600 feet
- On shorter hauls tonnage ranges up to 2-tons a minute.
- On longer hauls, tonnage ranges down to 1-ton a minute.

This HIGH tonnage production is accomplished by:

One Man
One S-D Gismo Transloader

How can one man and one piece of equipment do so much work? Because the Sanford-Day Gismo Transloader is BOTH a mucking-machine and a truck ALL-IN-ONE!

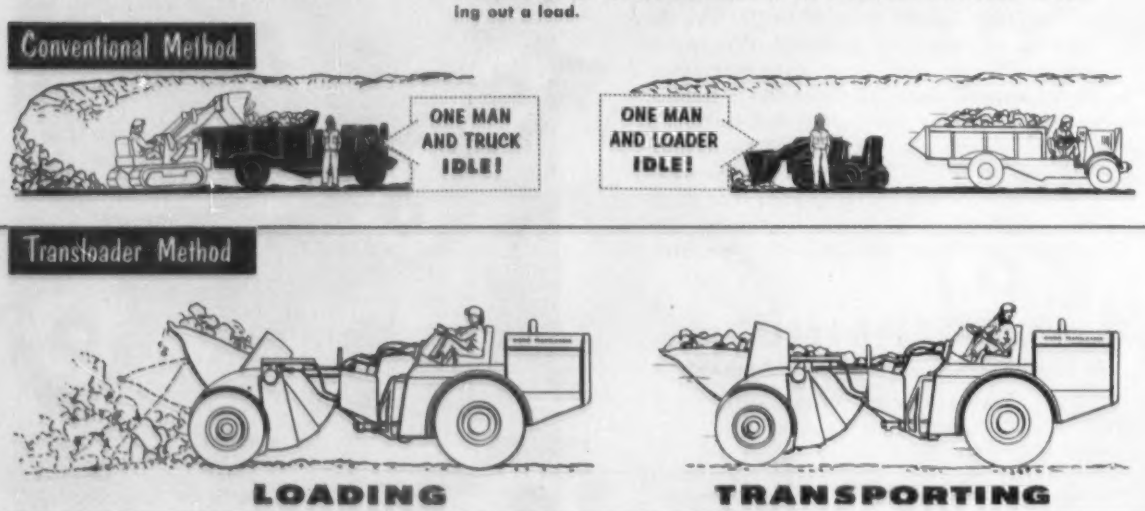
It is a high-speed transport — up to 20-miles per hour either direction! The fact it self-loads enables you to completely eliminate idle time of both men and equipment! Therefore, less capital investment required for additional equipment and manpower to do the job.

In conventional loading of materials, the loader is dependent on auxiliary equipment such as truck or shuttle car, etc. The loader cannot operate without the auxiliary conveyance. Neither does the haulage system operate while being loaded. Thus idling of men and equipment.

Compare this with the S-D Gismo Transloader. When Transloader is operating, man and equipment are working all the time; either mucking or transporting to dumping point! NEITHER THE TRANSLOADER NOR ITS OPERATOR ARE EVER IDLE! They are continuously at work in uninterrupted cycles!

Visualize one or several S-D Gismo Transloaders, each with only one man, MUCKING AND HAULING in your development or production work. Savings are tremendous! Write or call us today. *Manufactured by Sanford-Day Iron Works, Inc., Knoxville, Tenn.*

This photograph catches the action of the S-D Gismo Transloader mucking out a load.



# "Mucks-Hauls-Dumps" 100-tons an hour!

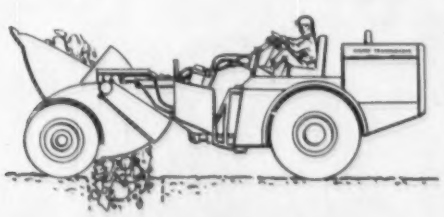
Here you see S-D Gismo Transloader with large, wide dipper down under hard rock. Transloader makes its own roadways and cleans-up completely . . . also moves large boulders for secondary blasting.

. . . and here is dipper raised with full load. This high-powered, high-speed Transloader operates on grades, in favor or against the load . . . negotiates, turns, etc.

This tramming scene (on way to raise) shows S-D Gismo Transloader as truck-transport.

Here load is being dumped into raise. Transloader also backfills waste, or dumps directly into bin . . . or by simple ramps over trucks, cars, conveyors, etc.

**THE GISMO TRANSLOADER,** rubber-tired Gismo Self-Loading Transport, is an advanced equipment development that is a perfectly natural result of the performance of the Gismo powered by crawler-mounted tractors developed a few years ago and doing an outstanding job in mechanized mining today!



**DUMPING**

## SANFORD-DAY

## KNOXVILLE, TENNESSEE

- S-D Mine Cars, all types and kinds.
- Precision S-D Mine Wheels.
- Tough, year-after-year wheel service by special S-D wheel Hard-Facing Process (this can really save you money and eliminate downtime).
- S-D "Brownie" Hoists. • S-D Car Spotters.
- S-D Mine Sheaves and Rollers.
- S-D Slusher-Trains for mining and construction industries.
- S-D Gismo Transloader for mining and construction industries.

# How AMSCO helps you MOVE

*User Reports:*

**"OVER 13 TIMES MORE SERVICE LIFE ...WITH AMSCO 'MML' ALLOY"**

"Working in semi-molten slag at temperatures up to 1800°F., an AMSCO 'MML' ALLOY dipper front lasted 528 days. That's 13 times more service life than we got from the type previously used . . .; which gave a maximum of only 40 days' service." AMSCO "MML" ALLOY is a special combination of austentic manganese steel and molybdenum, specifically developed for applications involving excessive heating as well as severe abrasion.

*User Reports:*

**"AMSCO SIMPLEX TOOTH GIVES 18 WEEKS EXTRA SERVICE"**

"We're getting between 15 and 18 weeks extra service by using AMSCO Simplex dipper teeth", reports Mr. Fred Weber, Jr., Vice-President of Vigus Quarries, St. Louis, Missouri. "This gives us almost 4 times the service life we've been getting from standard teeth in our rugged limestone quarrying operation."

Mr. Weber also found that 2-part, reversible Simplex dipper teeth were so much easier and quicker to replace that his shovels were back on the job in no time.

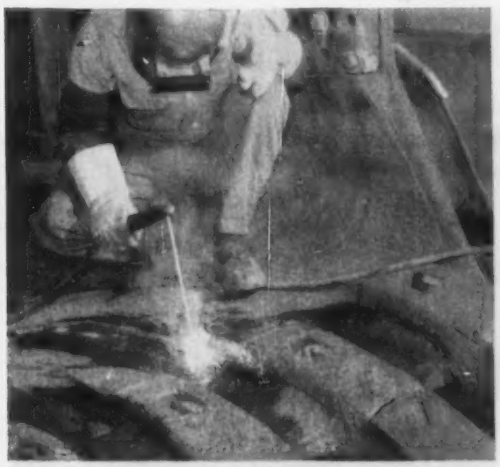
# MORE TONS PER DOLLAR

## *For rugged digging, crushing, pumping, or rebuilding jobs... it pays to ASK for AMSCO!*

AMSCO's sole job is to help you fight wear caused by impact and abrasion. AMSCO Manganese Steel—"the toughest steel known"—is today's number one choice for long-lasting dippers, dipper parts, crushers, tractor parts.

AMSCO Alloys, developed to meet unusual wear problems, add extra service life under special and very severe operating conditions.

AMSCO Hardfacing Materials permit economical build-up or repair of worn parts—at a fraction of the cost of new parts. Use this specialized know-how and broad line of "wear-fighting" products to help *your* equipment move more tons per dollar. Ask for AMSCO!



**NOW...WELD MANGANESE AS EASILY AS MILD STEEL**

"We're getting just the kind of welds and build-up we want with good cost saving to boot," says a user of Nicro•Mang rod. From all over, in a variety of hardfacing applications, reports of success with AMSCO NICRO•MANG are coming in. Users like the stable arc, and wide range of arc length . . . the non-popping, the easy removal of slag . . . and above all the fast build-up. For high strength, superior crack resistance, and easy welding, Nicro•Mang is unbeatable for fabrication and build-up of manganese steel.

**"29 YEARS WITH THE SAME 8" AMSCO PUMP"**

Haskell Peel, Plant Superintendent at Consolidated Gravel Company, Columbus, Georgia, has shared many experiences with his 8" AMSCO PUMP. One of his favorites is the time that he and his pump almost dried out a lake to recover a sunken dredge. He hooked the 8" AMSCO to more than 1,000 ft. of 10" pipe, and ran it continuously for three days. No wonder the pump is his pet . . . it's been doing the job, pumping 75% sand and 25% gravel, for more than 29 years.

AMERICAN Brake Shoe COMPANY

# AMSCO

**American Manganese Steel Division • Chicago Heights, Ill.**

Other Plants In: Denver • Los Angeles • New Castle, Dela. • Oakland, California • St. Louis
In Canada: Joliette Steel and Manitoba Steel Foundry Divisions
Welding products distributed by Canadian Liquid Air Co., Ltd.

# YARDS AHEAD

## CW-226 A COMP

**MODEL CW-226**

2-axle, self-propelled scraper designed for rated capacities of:

**26.0 Cu. Yds. Struck**
**36.0 Cu. Yds. Heaped**

| | |
|---|---|
| Travel Speeds | to 34.4 m.p.h. |
| Load Capacity | 78,000 lbs. |
| Interchangeable with Curtiss-Wright model CWD-221 Rear Dump | 21 Cu. Yds. Struck<br>31 Cu. Yds. Heaped<br>70,000 lb. Capacity |

**CURTISS-WRIGHT**
**SOUTH BEND**
**SOUTH BEND,**

# . . . NEWEST AND LARGEST OF LETE LINE OF EARTHMOVERS!

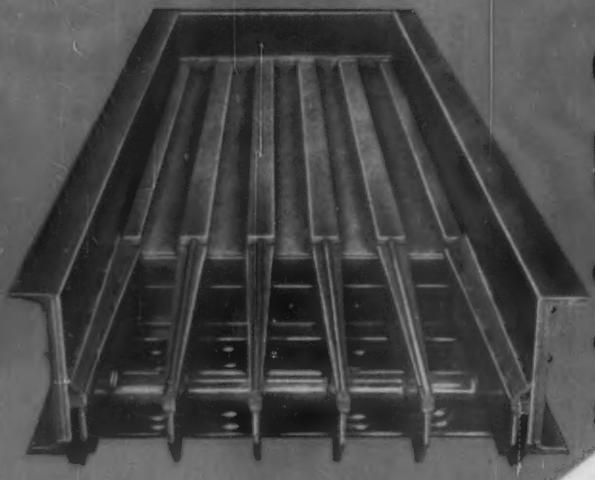
The 26 yd. CW-226 is the newest and largest addition to the Curtiss-Wright line of self-propelled scrapers . . . and the newest and largest *practical* unit for your job. It's a *high speed* machine with *exclusive* Curtiss-Wright "Roto-Gear" steer and 375 h.p. engine for the maximum in speed and control—A *high output* machine combining all the tested and proven features that give heaped loads, smooth spreading and fast cycles—A *dependable* machine with rugged basic design and unit construction for long life and simplified maintenance . . . All these features put the Curtiss-Wright CW-226 years ahead in design—yards ahead on the job, and put YOU dollars ahead on the profit sheet . . . see it in action!

**CORPORATION**
**DIVISION**
**INDIANA**

# SIMPLICITY

## GRIZZLY FEEDER

### eliminates need of apron feeder and scalper . . .

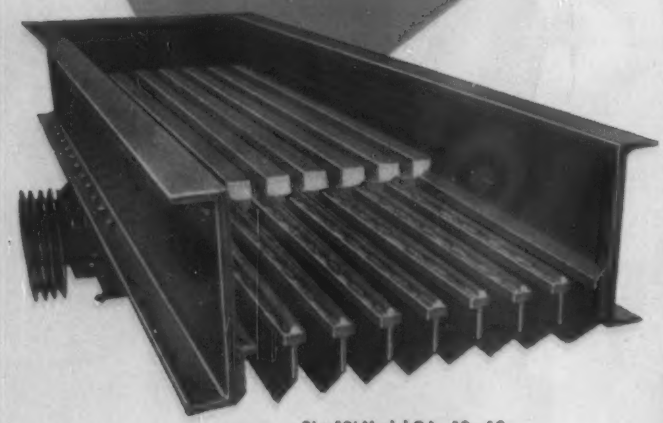


3' x 10' Model OA—10—A3

### *Rock can't jam . . . hourly operating costs lowered*

The unique design of the Simplicity Grizzly Feeder, which combines feeding and scalping in one operation, eliminates rock jams thus assuring positive uniform flow of material into the crusher.

One operator of a Simplicity Grizzly Feeder says: " . . . we have used the heaviest type of apron feeders for years and have found it necessary to shut down at least 2 or 3 times a year to hard surface the flights, inasmuch as our material is so abrasive . . . we installed a Simplicity (Grizzly) Feeder . . . with 1/4" pan and 3/16" liner . . . and are glad to report that, AFTER 9 MONTHS OF CONTINUOUS OPERATION, THE FEEDER PAN SHOWS PRACTICALLY NO WEAR WHATSOEVER, and is operating around the clock doing an excellent job of feeding at all times . . . "



3' x 12' Model OA—10—A3

The Grizzly Feeder costs less than 50% of the combined apron feeder and scalper . . . weighs considerably less . . . makes a more compact plant . . . and reduces loading height by several feet. While these factors show up so prominently in portable plant production, they are just as effective in a permanent plant installation for the crushed stone, sand and gravel and mining industries.

214

Send for Catalog #371 for complete information on OS-A-VEYOR and GRIZZLY FEEDERS.

SALES REPRESENTATIVES IN ALL PARTS OF THE U. S. A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown & Sites, 50 Church Street, New York 7, New York

**Simplicity**
TRADE MARK REGISTERED

**ENGINEERING COMPANY • DURAND 4, MICHIGAN**

# E&MJ NEW PRODUCTS DIGEST

**In this issue—Hydromex wet explosive for wet holes, a free piston pump that moves anything that flows, an underfloor wiring system, tunnel forms, a two-in-one car haul and rotary dump, a finance company's installment buying program, a new synthetic flocculant, and 40 new literature notices to examine.**

**BEFORE BLAST** at Lowphos Ore Ltd.'s low-grade iron ore pit, typical face shows tough rock. Holes are often very wet.

**AFTER BLAST,** over 78,000 tons of ore lie shattered into a size easily loaded by power shovels and in compact pile.

## Water Compatible Ammonium Nitrate Mix Goes to Work in Canada (1)

HYDROMEX, the ammonium nitrate-TNT-water slurry-explosive recently developed by Iron Ore Co. of Canada and Canadian Industries Ltd., is being used to re-open the Moose Mountain iron mine in Northern Ontario.

The slurry explosive was developed to overcome the wet hole problem when using cheap but soluble ammonium nitrate blasting agents. Water actually enters the explosive reaction in Hydromex, increasing the gas volume and, hence, the pressure. The explosive's high density and the absence of air in or around the charge further improves performance and economy. Moreover, the desensitizing effect of water adds protection against fire or impact hazards.

The thick-soup material is furnished by CIL in 50-lb units packed in polyethylene bags. It is primed with a likewise newly developed small block of cast pentolite, called Pento-Mex, which is attached to Primacord detonating fuse.

The new explosive contains roughly 15% water, 20% TNT (about 10 mesh) 65% AN. Its density is about 1.4 gm/cc (about 1.7 times AN-oil) and thus will sink in water. It is also less sensitive than AN-oil mixture.

The cost of Hydromex is higher than AN-oil, but its greater strength and density permit greater burdens and give better fragmentation, particularly in hard rock formations.

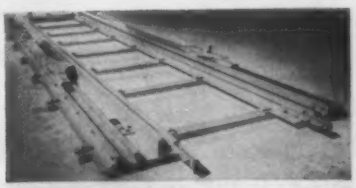
Tests at Moose Mountain show that maximum efficiency and economy in blasting results from using both Hydromex and AN-oil. In some cases, holes are bottom charged with Hydromex and topped-off, especially above water, with AN-oil poured loose into the hole. In other cases, some holes are fully charged with only one of the two types.

In one typical blast, the mine used 17,600 lb of Hydromex and 18,800 lb of ammonium nitrate pellets in 40 holes to shatter 78,000 tons of ore. The holes were 9⅞ in. dia, 22 ft apart, and from 36 to 46 ft deep. Primed with 160-gram Pento-Mex primers, the charges in each hole were set off on a split-second pattern of 15 milliseconds between holes.

Lowphos Ore Ltd. is spending several million dollars to reactivate the property located some 16 miles north of Capreol. The mine was originally opened in 1906 but abandoned in 1915 because the low-grade 30% ore was unprofitable to mine with the then-known methods. A new mill has been operating since April, upgrading the ore to 60%. Concentrate is being stockpiled pending completion of a spur from the CNR mainline and a shiploading facility at Parry Sound. Shipments are expected to start in June.

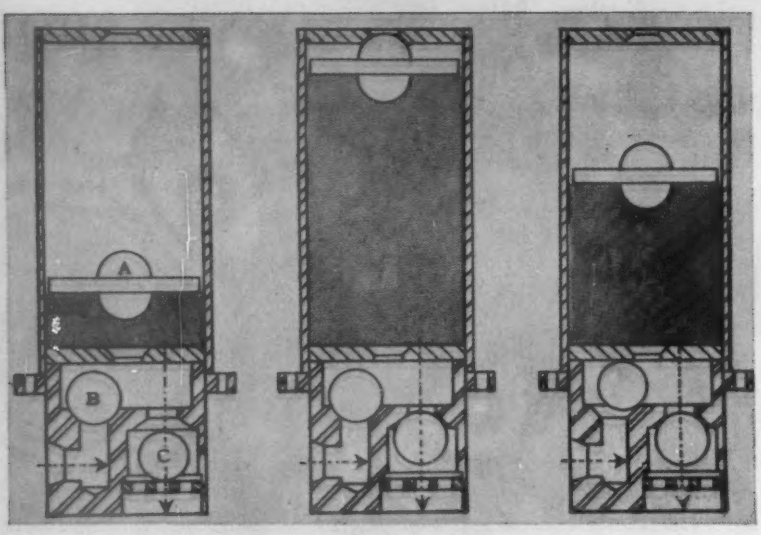
**BAGGED SLURRY** is primed by small Pento-Mex block threaded on Primacord.

**MILLISECOND DELAYS** minimize flyrock. Steel shed protects the blasters.



## Car Feeder Cuts Down Time (17)

THE SPLIT-TRACK Porta-Feeder unit announced by Nolan Co. mounts the operating mechanism on both sides of the track, rather than between the tracks as in the standard model. Advantages claimed are that all parts are easily and immediately accessible and that no part of the feeder can interfere with mine car axles, couplers or brake rigging.



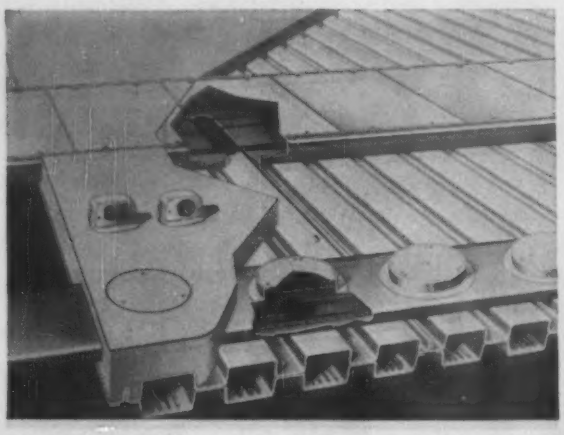

## Free Piston Pumps Anything That Flows — Mud or Molten Metal (2)

AT CROSSLEY Machine Co. a pump has been under development for the past year-and-a-half that has no moving parts, no shaft, no seals, no packing, needs no lubrication and runs on air (or steam). The Crossley Free-Piston pump will pump abrasives, slurries, molten metal up to 2,000 deg F, acids, mud, sludge, concrete—and it will pump them without pulsating or surging and without introducing air into the pulp.

Height to which mine water could be hoisted is limited only by the air pressure available and by the number of stages used. And for handling slurries, there seems to be no limit on the top size in the feed for while Crossley has yet to do it, they feel that they can design a pump to handle dredge and phosphate rock type feeds.

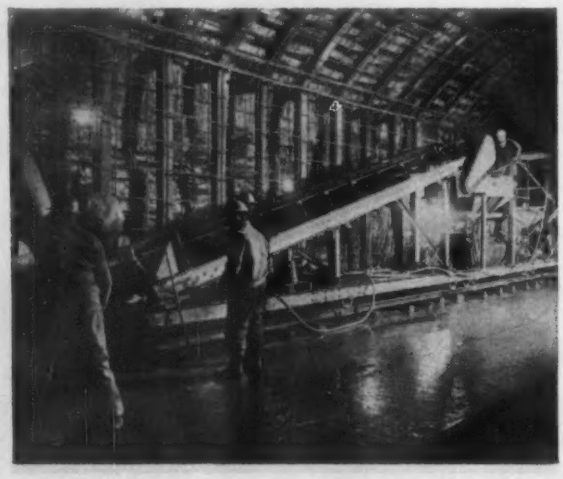
The pump has three chambers which operate in an overlapping sequence. Any one chamber can be repaired while the other two continue to operate. Going from left to right in the photo above, the left chamber is discharging using air pressure introduced at the top drive down the free-floating piston (a), closing inlet valve (b) and opening outlet valve (c). Ball valve "b" is heavier than the slurry, while valve "c" is lighter than the feed (so that it will rise to seal when needed).

In the center, the cylinder is completely filled and at rest. Air charge is switched from the left cylinder to the central one just before flow from the one at the left stops. The third cylinder in the pump is being filled at this time. It can be filled by gravity or through a power system that uses the waste air pressure from the pump. Crossley Machine says that the pump can be made in any material for any size pumping job. It can be operated submerged in a slurry or molten metal. Current model available is 45x24x53-in. size and has a 100 gpm capacity for clear water. Its capacity can be varied by changing the air pressure inlet and outlet orifices.



## Underfloor Wiring For Cellular Steel Floors (11)

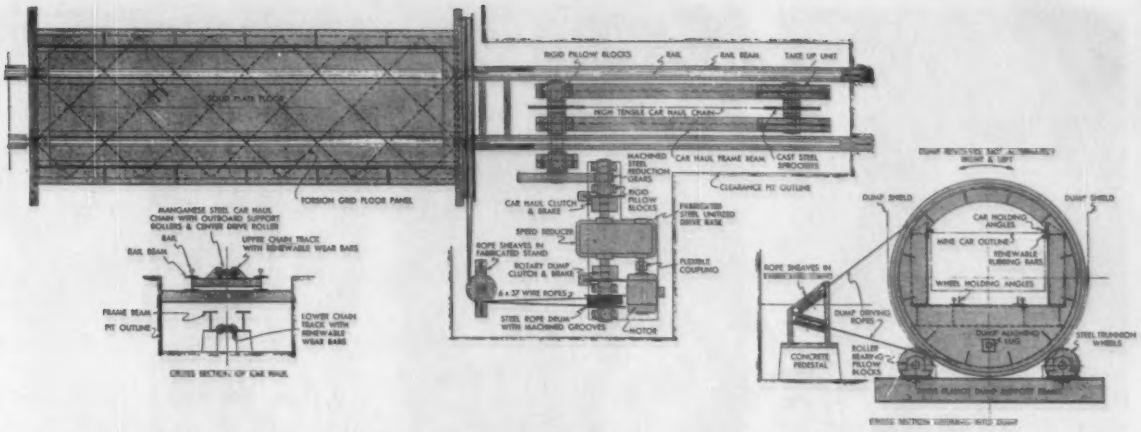
TWO HEADERDUCT underflow wiring systems, which provide more wiring capacity than any other system according to National Electric Div., H. K. Porter Company, Inc., have been designed for use with cellular steel floors. One system, known as the 15,000 Series, provides 20.294 sq in. of duct capacity. The other, 14,000 Series, provides 0.2 sq in. Both systems can be combined in one installation by using a special connecting device developed by National Electric. The 15,000 Series duct measures 2½x10 in. and is produced from 14-gage steel in 3- and 5-ft lengths. The 14,000 Series duct measures 1⅜x7¾ in. in 8-, 9- and 10-ft lengths.



## Telescopic Forms Cut Tunnel Lining Costs (9)

DESIGNED, fabricated and modified by Blaw-Knox Co., the forms used by Merritt-Chapman & Scott Corp. to line the Ft. Pitt Tunnel helped speed setting, stripping and moving time considerably and provided a better concrete finish through highly uniform construction operations. Forms are made so that one can pass collapsed through another while concrete is curing. Forms are mounted on a jumbo-traveler.

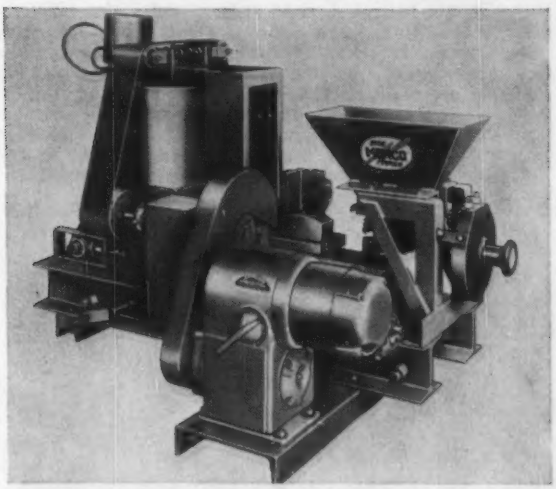
**For more information, use card opposite page 44.**




## Two-in-One Car Haul and Rotary Dumper Operates From One Motor (6)

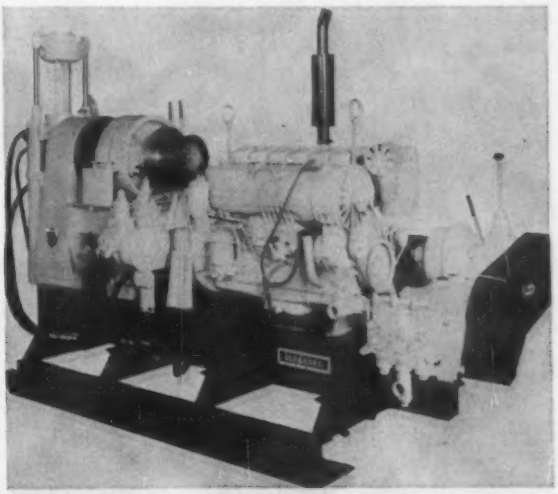
A SINGLE DRIVE unit powers the combination car hauler and rotary dumper designed by Connellsville Mfg. through a gear drive to the hauler and a wire rope drive to the dumper. Dumper drive is positive in that the ropes are anchored to the drum on the drive unit and the end ring of the dumper—the dumper operates clockwise one time and counter-clockwise the next. Coordinated car stops are hydraulic or pneumatic. Scales can be installed between the hauler and dumper.

Buyers will be required only to make a 15% downpayment in cash or trade with the balance payable in one to five years. Details are presented in a brochure.



## Cross Belt Separator Stresses Pole Control (5)

MAGNETIC Engineering & Mfg. Co. is producing a Memco CB high-power cross belt magnetic separator using the Memco-Hope design. The separator features increased effectiveness of the flux concentration through the use of as many as four wedge-shaped pole edges. The company reports that the Memco-Hope four-pole design is frequently equivalent to an eight-pole machine of other design. Each pole can be controlled individually through an adjustable magnetic circuit which is especially valuable when separating minerals of similar magnetic susceptibility. The separator can be had in sizes ranging from a 3-in. wide main belt laboratory model (one cross belt) to a machine having a 24-in. main belt and as many as eight cross belts. Capacities as high as 8,000 lb/hr have been obtained on the 24-in. unit.



## Core Drill Has Multi-Speed Drilling Pump (7)

THE PHOTOGRAPH above shows a special Longyear "44" diamond core drill equipped with a built-in multi-speed drilling pump (on the right end of the machine). The "44" is rated at 1,800 ft with NW rod and 3,000 ft on AW. Engine is a Deutz F6L 712 air-cooled diesel.

## Finance Company Sets up Installment Buying (12)

A PLAN announced recently will enable mining equipment manufacturers to set up installment buying programs for their income-producing equipment. Standard Financial Corp. will handle complete financing, collections and paper work at no extra charge. The finance company will furnish the manufacturers with the necessary contracts, credit applications, notes, will check the customer's credit position anywhere in the country within three days and assume the chore of collecting the purchase price.

## Timber Framer Finishes Three Pieces a Minute (10)

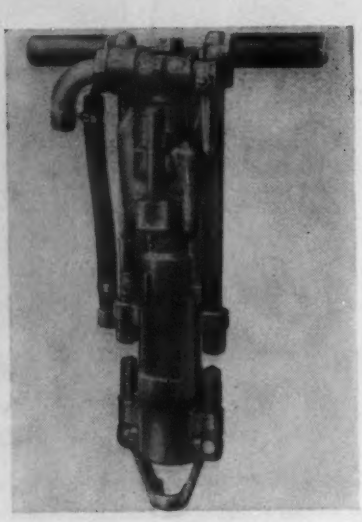
THE BURKE E. Porter Machinery Co. timber framer has been developed to tenon and slab heavy timbers in an automatic, production operation. Either rounds or cants are fed to the machine, which can double and trim, cut clean sharp tenons and discharge at the rate of three pieces per minute. Framer is conveyor-fed through the end of the machine. No. 284 Porter timber framer machine is fully integrated; electrically actuated hydraulic controls govern all operation sequences. Another companion piece manufactured by Porter Machinery is the Porter No. 228 wedge machine that can turn out mine wedges at the rate of 2,000/hr.

## Bit Remover Saves Steel (13)

DEVELOPMENT of a bit remover by Holman Brothers Ltd. brings to an end the many frustrations and headaches associated with the removal of stubborn bits. Tests carried out by Holman Bros. shows that fracture of rod tapers and damage to bits and their tungsten carbide inserts has been caused by hammering the bit body while trying to separate bit from steel. Holbit Remover fits ⅞-in. hex steel.

## Explosive Bag Sealer (16)

AN ELECTRIC heat-sealing unit designed to close a poly-lined Flexiply (multicreped) kraft bag used to package ammonium nitrate-fuel oil mixtures has been developed by Bemis Bros. Bag Co. Unit weighs only 25 lb, operates on 100-v power and forms a ¾-in. seal through the Flexiply sheets in five sec.



## Heavy Weight Sinker (15)

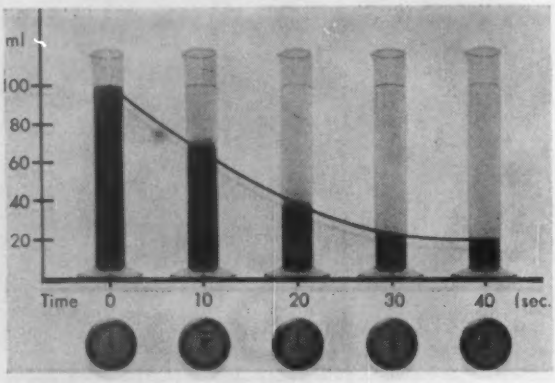
THE HANDRIL, designed by Holman Bros. Ltd. is said to be ideally suited for shaft sinking and heavy drilling where extra power is needed. Though primarily intended for hand-held drilling, the new H.C. 300 design can be readily adapted for airleg or drifter work. Drill can be supplied for wet or dry drilling. Weight is 78 lb. The drill has a 3-in. bore, 2⅜-in. stroke with a 4½x1-in. hexagonal chuck.

## $2-Million Refractories Research Lab Opens (3)

A $2-MILLION REFRACTORIES RESEARCH CENTER was opened June 2 by Harbison-Walker Refractories Co. in Pittsburgh, Pa. The Garber Research Center was named in honor of Earl A. Garber, Harbison-Walker's president, under whose administration much of the company's expansion has taken place. The center is designed for development of refractories used in the manufacture of iron and steel, aluminum, brass, copper and other nonferrous metals.

The facility is divided into two main buildings with offices and instrumental research in one and the pilot plant for product development in the other. Mineral identification laboratories contain equipment for studies with transmitted and reflected light, emission and x-ray diffractometer for crystal or mineral identification and an analytical laboratory and photographic facilities.

An example of the results of Harbison-Walker research is their new Coralite 3-59 which they believe will greatly benefit aluminum metallurgy. The refractory is nearly unreactive to aluminum alloys.




## Flocculant Comes in Granular Form (4)

SUPERFLOC 16, American Cyanamid Co.'s newest high molecular weight flocculant, is particularly effective in thickening operations for increasing settling rates and overflow clarity. Illustrated above is the effect of adding 0.05 lb of the new polymer to a ton of acid-leached uranium ore. Slimes are completely settled in 40 sec. With untreated slimes, settling time would be at least 27 times longer and the overflow might not be clear.

## Coal Auger Drills to 100 Ft (8)

A NEW LINE of underground coal recovery drills capable of handling augers from 24- to 44-in. dia and 5-ft lengths has been designed by Salem Tool Co. Drill and its separate power unit are self-advancing on skids and jacks. It can produce as much as 40 tons per man-shift. The cutting head revolves at 33.75 rpm with a forward speed of 6 ft per minute, and is capable of drilling to 100 ft. A three-man crew can handle all operations.

# For Your Files

**This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.**

### Exploration and Mining

**BLASTCORDER** Model 5050—a practical field tool to control and protect blasting operations—is discussed in literature from Geotechnical Corp. **(60)**

**MINING TOOL** catalog from Allegheny Ludlum Steel Corp.'s Carmet Div. is in its 6th edition. Illustrated, 20pp. **(61)**

**ROPE THREAD** Rok-Bits, Carbo-Rok extension steel, couplings and striking bars are illustrated in Brunner & Lay, Inc. catalog. **(62)**

**LIFE - SAVING EQUIPMENT**—Mine Safety Appliances Co.'s Porto-Power hydraulic rescue kit—is described in illustrated literature. **(63)**

**RESPIRATOR-GOGGLE** combination designated the AO R4000 by American Optical Co. is illustrated in a four-page bulletin. **(64)**

**LOW COAL LOADER,** the Goodman 964, is described in a two-page flier as is the Goodman Low Coal shuttle car. **(65)**

**SHUTTLE CAR** with ac or dc single motor torque converter drive—the TorKar designed by National Mine Service Co.—is presented in a four-page bulletin. **(66)**

**PREPARING** and handling sand for hydraulic stope filling is the subject of an Engineering Notebook Bulletin prepared by Denver Equipment Co. Graphs, flowsheets and illustrations aid the text. Bulletin G3-B66. **(67)**

**HYDRAULIC** shop presses, featuring Owatonna Tool Co. Power-Twin center-hole hydraulic rams, are the subject of a 12-page bulletin (SP8). **(69)**

**HYDRAULIC** railroad axle journal bearing puller and installer designed by Owatonna Tool Co. is presented in a four-page bulletin (HYRR-57). **(70)**

**HYDRAULIC** track press for servicing tractor crawlers is discussed in a four-page bulletin from Owatonna Tool Co. (TM-8). **(71)**

**CAR HANDLING** and dumping equipment — rotary dumpers, car hauls, feeder-retarders, car spotters—in the Connellsville Mfg. line are introduced in a four-page bulletin (300). **(72)**

**INSTRUCTIONS** for installing and maintaining electric storage batteries type KX-A, MEG, MEH, MEH-A, MEX, MG, ML, MVM, RG, TEG, TG, TH, TLM, from Exide Industrial Div., Electric Storage Battery Co. are published in a 19-page bulletin (1982). **(73)**

**HOW** Exide-Ironclad batteries make every fork lift truck more productive, reduce operating and ownership costs are illustrated in an eight-page bulletin (6230). **(74)**

**INSTRUCTIONS** for operation, maintenance of vertical-line single-circuit motor-generator chargers for lead-acid storage batteries marketed and serviced by Exide Industrial Div., Electric Storage Battery Co. are printed in a four-page bulletin (58-45). **(75)**

**FACTS ABOUT** storage batteries, a 31-page booklet prepared by Exide Industrial Div., is available upon request. Interesting, informative. **(76)**

**MINE FAN** and circuit breaker monitoring and control system—the Femco 709 System—is fully explained in a two-page data sheet from Femco, Inc. (5902). **(77)**

**BUCKET CRANES** and overhead material handling equipment in the Northern Engineering Works line are introduced in a four-page bulletin (B-1020). **(78)**

**GYROL** fluid drives to pipeline pumping stations for flow control are presented in an eight-page bulletin (A-519) offered by American-Standard Industrial Div. **(79)**

**SHOVEL** and bucket parts of manganese steel from Columbia Steel Casting Co., Inc. are introduced in a four-page bulletin (1067). **(80)**

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**ENGINEERING & MINING JOURNAL**
**330 WEST 42nd STREET**
**NEW YORK 36, N. Y.**

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### Earthmovers

**FIVE YARDSTICKS** for measuring big tractor values are applied to D8 and D9 class Caterpillars in an eight-page bulletin (33341) from Caterpillar Tractor Co. **(81)**

**COMPLETE ENGINE** line of International Harvester Co. is discussed in a four-page folder. 24 power units —4's, 6's, and V-8's from 16.5 to 385 hp are listed. **(82)**

**THE USE** of scrapers and wagons with the Caterpillar Tractor Co. DW-20 wheeled tractor is explained in an eight-page bulletin entitled "Make the Right Turn" (D912). **(83)**

**SPECIFICATION** bulletins on three Trojan tractor shovels, ranging in size from 4½- to 6-ton lifting capacity, are offered by Trojan Div., Yale & Towne Mfg. Co. **(84)**

**CRAWLER TRACTOR**—the Euclid twin-powered TC-12—is illustrated and described in a 23-page bulletin from Euclid Div., General Motors Corp. **(85)**

**PRODUCTION EQUIPMENT** for modern mining is the title of International Harvester Co.'s 15-page bulletin (CR-665-1 2-13) which illustrates salient points of International power and engineering. **(86)**

**HEAVY-DUTY** loaders and backhoes for International Harvester Co. utility tractors are presented in a 16-page bulletin on the Wagner line. **(87)**

**TRACTOR** and tractor units for Eimco Corp.'s Series 105 are detailed in a 16-page booklet. **(88)**

**CONVERTIBLE** shovel—the Manitowoc Engineering Corp.'s Model 3100, 2½-yd—is described in literature available. **(89)**

**TWO MOBILE** electric cranes have been announced by R. G. LeTourneau, Inc. according to literature available on the Series 30 (30 ton) and Series 45 (45 ton) which feature electric wheels and all electric operation. **(90)**

### Auxiliary Equipment

**CONVENIENT** tables and formulas —a booklet which reprints chapter 23 of Westinghouse Electric Corp.'s ELECTRICAL MAINTENANCE HANDBOOK —is available upon request. Contains 120 pages of tables, formulas, symbols, material properties. **(91)**

**OIL-IMPREGNATED** chain bushings of sintered steel, an exclusive patented development by Whitney Chain Co. is discussed in literature available. Whitney claims that drive chains fitted with oil-impregnated bearings will outlast other types 5:1 in severe operating conditions. **(92)**

**OPEN STEEL** flooring types from Blaw-Knox Co. are presented in a Booklet. 24pp. **(93)**

**UNMOUNTED** oil-immersed ac contactors (Type 426) are described in Allis-Chalmers Mfg. Co. bulletin (14B8752). Unit is designed for hazardous, corrosive or dusty conditions and is rated at 400 amp, 5 kv, 50 mva. **(94)**

**INDUSTRIAL** power units—multi-fuel V-12's designed for applications where high horsepower and low unit weight are desired—rated at 550 hp at 1,800 rpm on butane or gasoline and 450 hp on natural gas are described on a two-page flier from Hercules Motors Corp. **(95)**

**RECTIFIER** bulletin from General Electric Co. clearly defines the attributes and limitations of selenium rectifiers, particularly G.E.'s Vac-u-Sel design, so that the equipment designer or maintainer can be guided in their application. (ECG-344 12-58). 23 pp. **(96)**

**FOUR DIFFERENT AWC** wire sizes are being offered by Chester Cable Corp. in a new line of submersible pump wire for installation in artesian or other deep wells. New wire is described in literature. **(97)**

**HONEYWELL 800,** a superior scientific computer is the title of a 12-page bulletin which describes an all transistorized electronic computer system that will be available to industry for delivery before the end of 1961. **(98)**

**SELF - CONTAINED** temperature regulator for the control of water, gas or low pressure steam is described in Barber-Colman Co.'s data sheet F-9310. **(99)**

**CEMENTS,** mortars and coating for industrial furnaces and other high temperature applications are described in Mexico Refractories Co.'s 17-page bulletin (CMC-559-30M) **(100)**

**HEAVY MEDIA** recovery magnet designated Stearns Magnetic Products Indox V Type WPD, is presented in a two-page bulletin (2102). **(68)**

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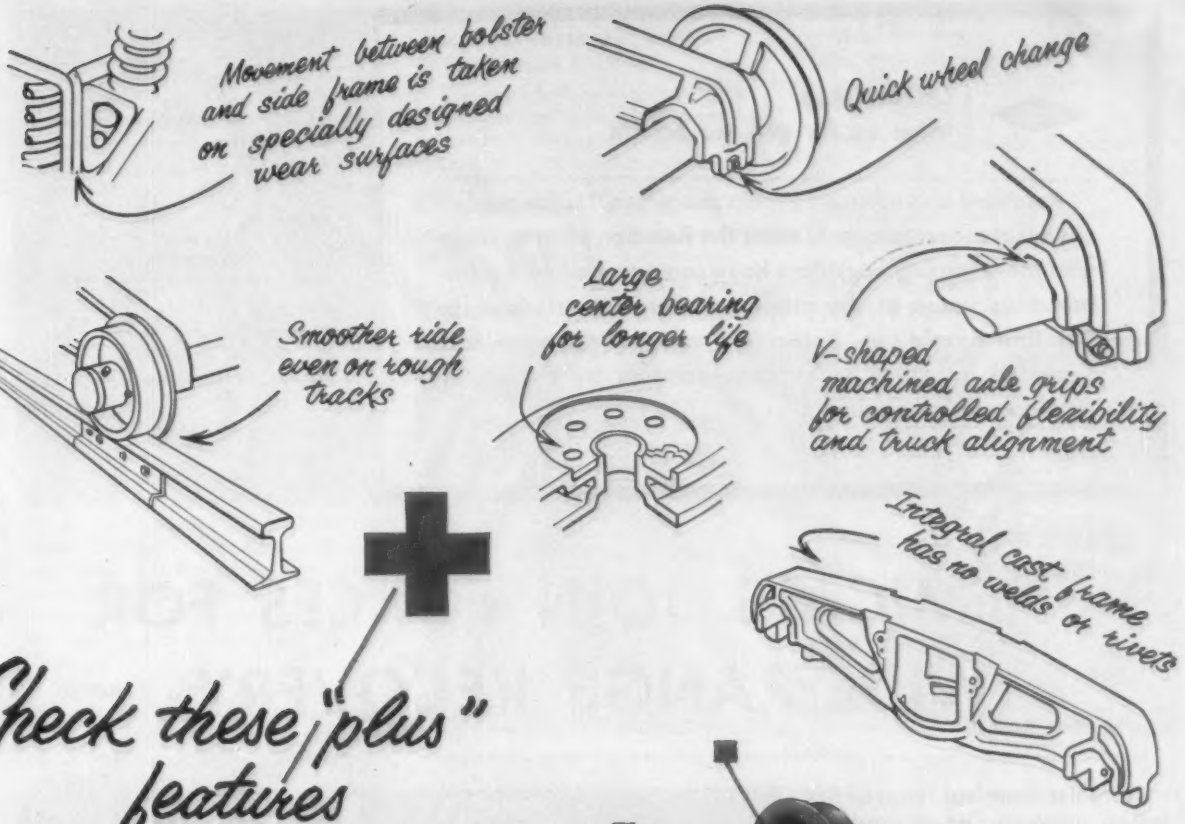
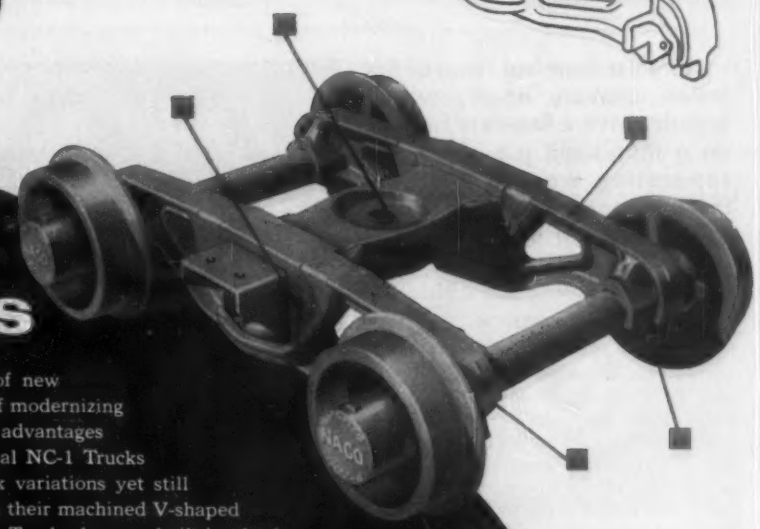

Movement between bolster and side frame is taken on specially designed wear surfaces
Quick wheel change
Smoother ride even on rough tracks
Large center bearing for longer life
V-shaped machined axle grips for controlled flexibility and truck alignment
Integral cast frame has no welds or rivets

# Check these "plus" features OF NATIONAL NC-1 TRUCKS



If you're considering the purchase of new 8-wheel mine cars . . . or if you're thinking of modernizing older cars—*now* is the time to check the advantages of National NC-1 Trucks. National NC-1 Trucks have controlled flexibility for track variations yet still maintain truck alignment through their machined V-shaped axle grips. In addition, NC-1 Trucks have a built-in shock absorbing mechanism.

You get more out of your mine car investment per workshift . . . per day . . . per year. And at the same time you minimize spillage . . . get greater protection for your equipment, track and structures . . . slash maintenance to a new low.

Yes, *now* is the time to check National NC-1 Trucks—they make sense for 8-wheel mine cars . . . *make dollars for operators*, too.

- WILLISON AUTOMATIC COUPLERS
- RUBBER CUSHIONED UNITS
- NC-1 CAR TRUCKS • NACO STEEL WHEELS
- NACO STEEL LINKS & SWIVEL HITCHINGS

AA-5077

**NATIONAL MALLEABLE and STEEL CASTINGS COMPANY**

*Established 1868* — *Cleveland 6, Ohio*

DOW **CHEMICALS**
***team up for greater profits***

**Recovery and ultimate profits rise when "tailor-made" chemical recovery agents enter the flotation picture. More and more mining operators have come to realize the tremendous value of the proper combination of these in flotation operations. Below are some nuggets of fact designed for quick, informative reading by the profit-minded process engineer.**

You may wish to check certain items in this advertisement and forward to those concerned in your company.

ROUTE TO:

_____

_____

_____

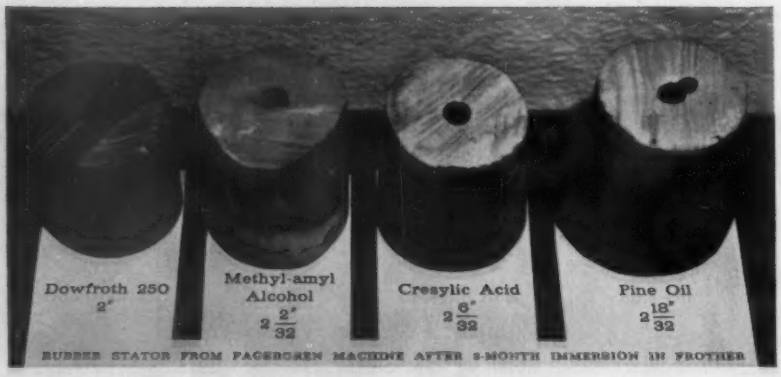
_____

# CHEMICALS JOIN FORCES FOR WIDE-RANGE RECOVERY

**Here's a chemical team of flotation recovery agents which, together with a first-rate frother, do a man-sized job of quickly separating wanted minerals from gangue and unwanted minerals, improving concentrates, lowering costs and greatly increasing the efficiency of flotation processing.**

Long used as standard sulfide mineral collectors, the nine Dow Xanthates play an increasingly important role in flotation recovery. As the gap narrows between costs and profits, new processing materials and methods become of prime interest to operators who wish to see profits return to the profit side of the ledger! Flotation research being carried out by Dow metallurgists and chemists shows how various combinations of Dow flotation chemicals can help operators to do just that!

A good example of teamwork among Dow's reagents is found in the flotation of copper minerals. A combination of Z®-200 and Z-11 plus Dowfroth® 250 is particularly effective for a wide variety of copper ores. Z-200 is highly selective and Z-11 adds its specific collecting properties to "backstop" the activity of Z-200. The results are higher grade concentrates, better metal recovery and increased economy in processing. An additional advantage of this reagent combination is that it eliminates the need for a continual inventory of many different reagents, while at the same time it provides high collecting power for virtually all of the sulfide copper minerals which may be processed.




Dowfroth 250 minimizes damage to rubber covered equipment.

It's well worth noting that Z-200, the newest of Dow flotation collectors, exhibits outstanding copper-iron selectivity, floating almost no free pyrite in lime alkaline pulps above a pH of 9.5.

Dowfroth 250, the third member of the trio above, is a powerful, noncollecting frother for *both* sulfide and nonsulfide minerals. It is completely water soluble. Its noncollecting power means that engineers can easily regulate frother and collector independently. Then there are the twin economies in maintenance and in cost-of-use. Since Dowfroth 250 is much less reactive with synthetic and natural rubbers than most of the other commonly-used frothers, rubber covered equipment such as stators, impellers and pumps are less often down for repair. Dowfroth 250 virtually pays its own way, too! It's effective at one-fourth to one-third the quantity required of other frothers, with resulting savings in frother costs and in storage space.

Dow research chemists are experienced in flotation chemistry, but they're constantly learning new tricks and new techniques in the more efficient application of recovery reagents to mining processes.

For the latest word about these techniques and the chemicals involved, send for a copy of the extremely interesting book "Flotation Fundamentals". Its 107

pages are packed full of facts and information that will prove highly profitable to *your* operations.

## FLOCCULATION
### *Settles problem suspensions*

Mining metallurgists who have been faced with problems in liquid-solid separations have had graphic proof that an effective answer to their problems can be achieved with the use of Separan® flocculating agents. These polyacrylamide-type settling agents adsorb onto the surface of minute suspended solids and settle them out quickly—often at hundreds of times the untreated settling rate.

By using Separan NP10, for example, one uranium processor planning a new facility recently eliminated from his plans four of the five thickeners, two banks of filters on the underflow from these thickeners and several impounding dams. The savings in the revised operation alone amounted to several thousand dollars per day, and at a cost of only a few dollars per day for Separan.

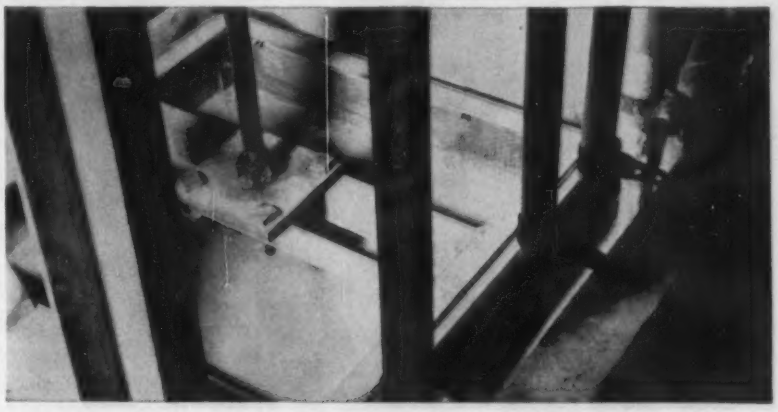
At present Dow's family of flocculating agents already have a long history of success. Each situation will determine which member of the family will do the best job for you. And in every case they are backed by fully experienced Dow technical men. When it's a question of liquid-solids separation, these men are anxious to be of service to you.

## ION EXCHANGE
### *Recovers, separates, and concentrates metals*

The process of ion exchange has made a mark for itself in many different fields, particularly where extremely valuable metals, such as uranium, are being recovered. The pregnant solution contacts a bed of ion exchange resins. The metal ions are concentrated in the resin beads and can then be readily recovered.

The profitable use of ion exchange resins is indicated when: (1) metal values are being recovered by less economical methods; (2) metal values are being lost; or, (3) recovery of metal values is economically impractical by other processes.

Dow's dependable family of Dowex® ion exchange resins is fast becoming a standard tool for copper recovery, columbium and tantalum recovery and separation, and molybdenum recovery. And Dow's skilled ion exchange technical team is ready to give you a hand when you need it.

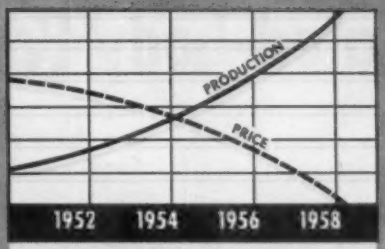


Flocculation research is proved out at Dow laboratories under simulated actual field conditions.

***If you'd like to know more about any of the chemicals discussed here, or about the many other Dow mining chemicals, write* THE DOW CHEMICAL COMPANY, *Midland, Michigan, Chemicals Merchandising Department 932BD7.***

## ON THE MINING CHEMICAL NEWSFRONT

**MAGNESIUM HYDROXIDE**
New idea in precipitants . . . more reactive, freer flowing, does not lump in storage. Uranium processors now using.




**CHELATING AGENTS**
The price of chelating agents is down . . . production capacity is up. Dow chelating agents such as Versene® inactivate troublesome metallic ions.

**MURIATIC ACID**
New! Fact-filled handbook about Dow muriatic acid. A "must" for everyone concerned with improving mining process operations.

**CAUSTIC SODA**
86-page caustic soda handbook puts a wealth of NaOH information in compact, useable form. Gives all the information about this essential chemical.

**DOW CHEMICALS *basic to the mining industry***

**Flocculants • Ion Exchange Resins • Preservatives • Chelating Agents**
**Ammonia • Solvent Extractants • HCL • Frothers • Chlorine • Calcium Chloride**
**Alkalies • Flotation Agents**

**THE DOW CHEMICAL COMPANY**
**Midland, Michigan**

DOW

# NOW...a year later...same still leads in availability ...with 96.1% working record

**—for Southern California Edison Co., Los Angeles, Calif.**

**A year later,** in 1959, still meeting and beating machine-mauling High Sierra rock-hauling conditions—on Mammoth Pool Hydroelectric Project, for Southern California Edison—the same 10-unit International 95 Payhauler fleet is still turning in this excellent record of availability.

With 2,500 to 2,700 working hours clocked on each unit of the fleet, the 10 Payhaulers delivered 96.1 availability in a recent measured month. The Payhauler fleet never lost a day due to mechanical failure! Performance like this has helped advance job-completion date substantially ahead of schedule!

**Southern California Edison Company** credits their excellent results partly to strong-built, easy-to-maintain machines—partly to a methodical preventive maintenance program. Working view shows two Payhauler units highballing rock fill to the dam site in 1959—maintaining record high availability!

# ...NEW corrugated-body Payhauler models

**New "95" Payhauler** gains 3 tons in capacity, plus an additional 40 diesel hp.—with new corrugated body design and new 375-hp. turbocharged International DT-817 diesel engine.

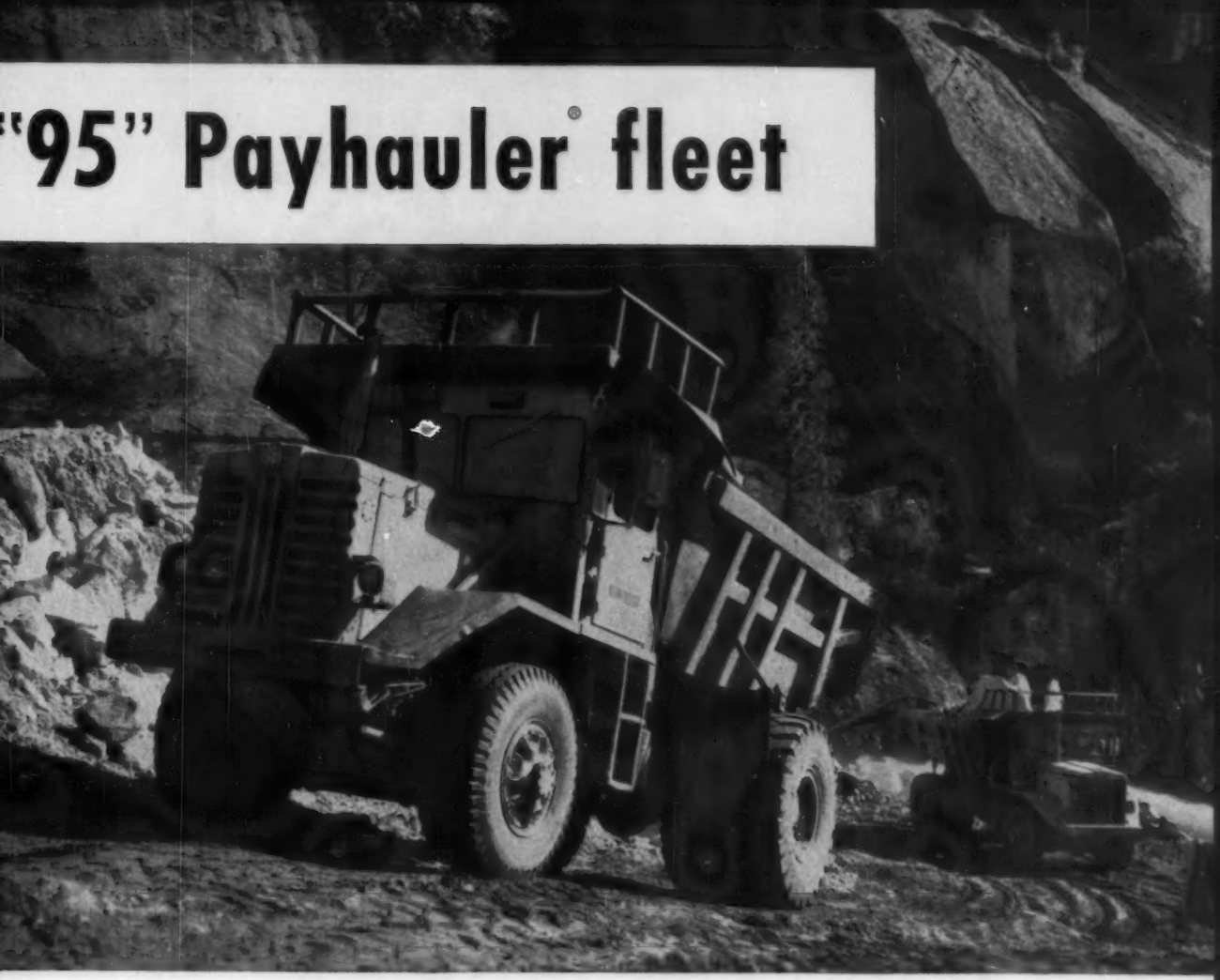
**See those exclusive, rock-ribbed body corrugations!** International applies this exclusive strength-multiplying principle to reduce the body-weight of new Payhauler models with these results:

- **New "95" Payhauler loses 2½ tons of power-wasting dead-weight; gives 3 extra tons of payload capacity!**
- **New "65" Payhauler sheds 5,000 pounds of useless "ballast"; gains a whole ton of new hauling capacity!**

And both these weight-streamlined Payhaulers have new International diesel power to highball the bigger payloads 14% faster than the previous models. These new Payhauler models have the power-to-weight ratio to out-cycle even lower capacity rigs.

**Get the proof that new Payhauler models can deliver and keep delivering** you the lowest material-moving costs in the off-highway hauling market. See your International Construction Equipment Distributor for a demonstration!

# "95" Payhauler® fleet



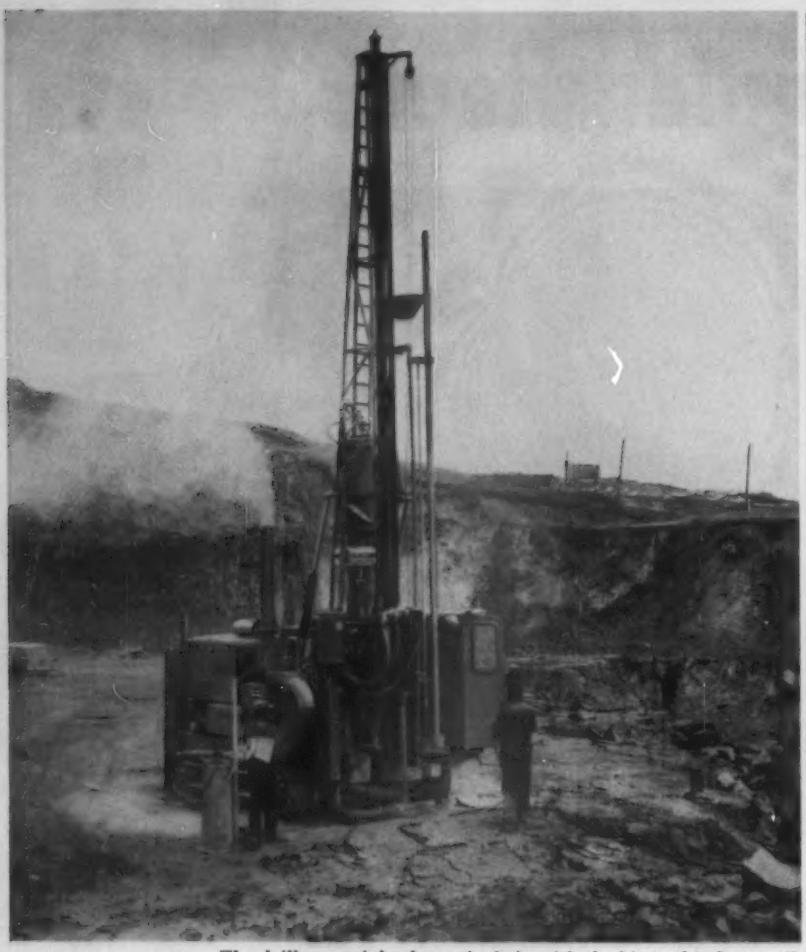
## *speed bigger loads...up to 14% faster!*

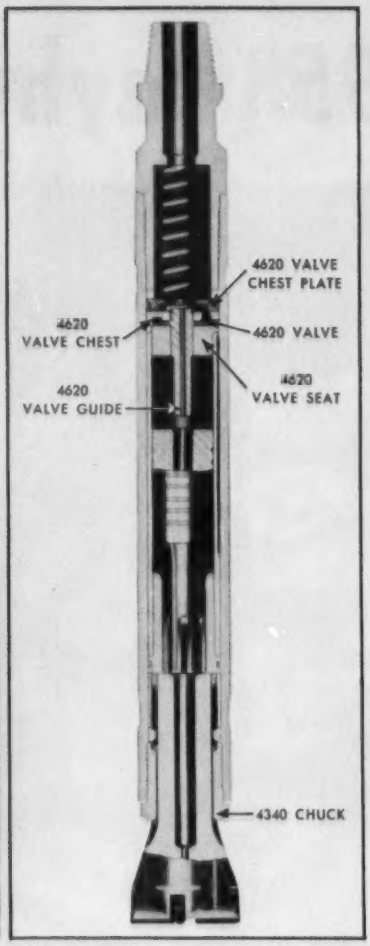
**New "65" Payhauler,** the only 19-tonner, features International's *exclusive* new corrugated body principle. Powered by the naturally aspirated new 250-hp. International D-817 diesel engine.

***International®***
***Construction***
***Equipment***

**International Harvester Co.**
**180 N. Michigan Ave., Chicago 1, Ill.**

**A COMPLETE POWER PACKAGE:** Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom-Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.






The drill goes right down the hole with the bit in this Ingersoll-Rand percussion drill. The piston strikes the bit shank directly, with 1,000 blows per minute.

# I-R Downhole drill gives "all-rock" versatility with rugged nickel alloy steels

Ingersoll-Rand is putting nickel alloy steels to work in one of the toughest mining and quarrying applications – drilling. Each Downhole drill has parts made of nickel-containing steel . . . parts that require high strength, toughness and hardness to stand up under equipment-wrecking conditions.

In mile after mile of hole – in every drillable rock – the Downhole drill has proved itself with these nickel alloy steels:

**Tough, Hard 4620 Nickel-Molybdenum Steel** – a truly ideal alloy for the air valve, seat, guide, chest and chest plate. This steel, when carburized, develops a good hard case with a bonus in core toughness and impact resistance . . . and it exhibits minimum distortion in heat treatment. This is especially important where critical tolerances are involved.

**Strong 4340 Nickel-Chromium-Molybdenum Steel** is used for one of the most critical parts – the chuck. Where the combination of high strength and toughness becomes crucial, nothing matches oil quenched and tempered 4340.

Ingersoll-Rand knows that nickel alloy steels provide the superior properties needed to keep mining and quarrying equipment operating day after day with a minimum of repairs. If you have metal parts that don't stand up, why not let nickel alloy steels prove their worth to you?

These two nickel alloy steels are carried by Steel Service Centers from coast to coast. For a list of sources, for information that will help you with your metal problems, write Inco.

**The INTERNATIONAL NICKEL COMPANY, Inc.**
67 Wall Street New York 5, N. Y.

# INCO NICKEL

NICKEL MAKES ALLOYS PERFORM BETTER LONGER

Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

# New Conveyor System

*. . . gives far greater belt life*

*. . . reduces maintenance*

## . . . and you get it *exclusively* from McNally Pittsburg

A completely new Cradle Idler* is the key to this high-efficiency McNally Pittsburg conveyor design. By mounting new 5" rubber rollers on a *nonrotating*, stainless steel rope, dangerous harmonics and "loping" are eliminated—permitting greater capacity and faster belt travel with minimum spillage. The *true catenary* of this suspension provides uniform belt support with no bends or creases—belt life is substantially increased.

Because of the unusual simplicity of this new McNally Pittsburg conveyor design, installation costs are lower—and maintenance costs are at a minimum.

*Patents Pending

New shock absorbing 5" rubber rollers have precision ground ball bearings, prelubricated and lifetime sealed.

With true catenary suspension, belts stay flat; support is uniform under all conditions for far longer belt life.

On-the-job construction is simple. The entire conveyor uses standardized components for easy assembly to fit your particular needs.

WRITE TODAY | for details on this new McNally Pittsburg conveyor which costs less to install . . . saves money every day it is in use.

**McNALLY PITTSBURG**

McNally Pittsburg Manufacturing Corporation—
Manufacturing Plants: Pittsburg, Kansas • Wellston, Ohio
Engineering and Sales Offices: Chicago • Rio de Janeiro
Pittsburg, Kansas • Wellston, Ohio

McNally Pittsburg Mfg. Corp.
Dept. EMJ
Pittsburg, Kansas

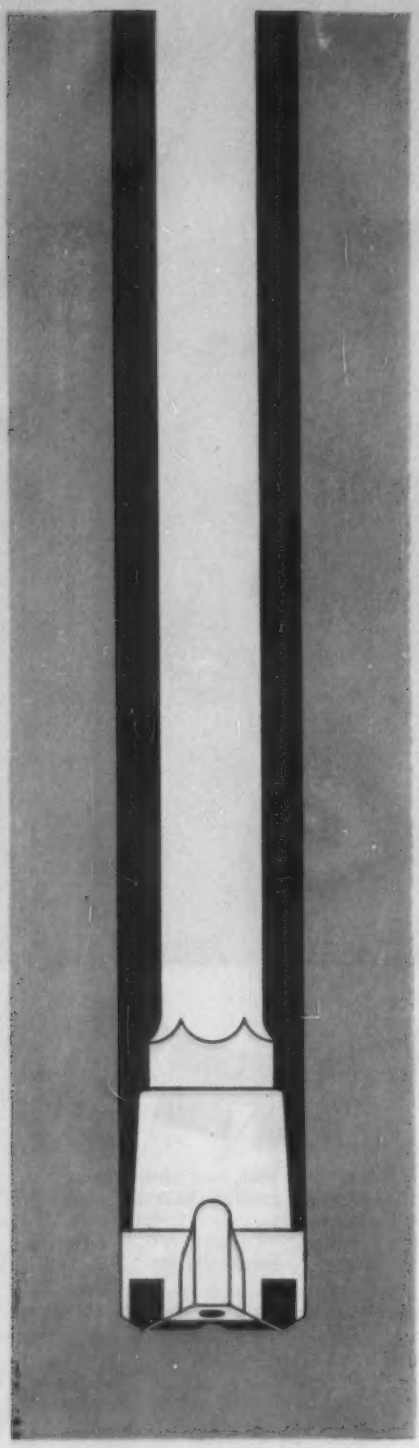
☐ Please send information on the new McNally Pittsburg belt conveyor.

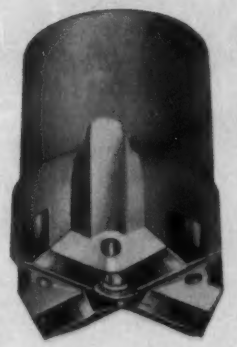
☐ Have Sales Engineer call for further consultation.

Name_____ Title_____

Company_____

City_____ State_____





# There's More Footage and Greater Economy in a Joy TC Bit

Here's why . . . Joy bit blanks are precision machined from a fine alloy steel, and a controlled heat treating process adds strength to give rugged service and long life. The carbide insert, a special grade selected for its extra footage-producing ability, is brazed to the bit blank by an exclusive process. This provides a super tough bond between the carbide and the bit blank—there's no lost time due to lost carbides.

These features, plus the excellent chipway design that provides maximum hole cleaning ability, keep Joy bits drilling longer. You get more hole per bit . . . more hole per shift . . . more production.

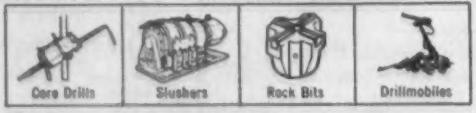
For proof of performance, contact your Joy representative. He will be glad to demonstrate Joy Tungsten Carbide Bits.

**YOU'LL FIND YOUR BIT SIZE IN THIS CHART**

| SHOULDER DRIVE | BOTTOM DRIVE | TAPER SOCKET |
|---|---|---|
| 1½" | *2½" | 1⅛" |
| 1⅝" | *2¾" | 1⅜" |
| 1¾" | *3" | 1½" |
| 1⅞" | *3¼" | 1⅝" |
| 2" | *3½" | 1¾" |
| 2⅛" | *4" | |
| 2¼" | *4½" | |
| 2⅜" | *5" | |
| 2½" | †4" | |
| 2¾" | †4½" | |
| 3" | †5½" | |
| *3½" | †6" | |
| *4" | NOTE: * x-type. †Rose design Others are cross type. | |
| *4½" | | |

Write for Bulletin 295-4

EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY

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JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

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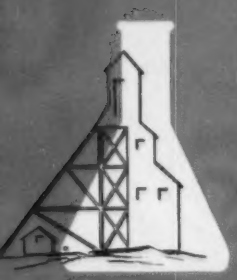

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"Because of this, we investigated every available loader on the market before buying our TL-20 TRACTOLOADER* in September, 1957. This decision was made on the basis of actual tests with each piece of equipment which indicated that the TL-20 consistently operated faster, reached farther, lifted higher and gave us more pounds per bucket than anything else in its class. *We would have had to spend $2,000 to $3,000 more for a machine which would equal its production potential.*

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"Now, with this one machine, we are handling 80% of our loading, and have not yet extended it to its limits. We have yet to become involved with any type of maintenance other than the normal routine upkeep required on any piece of mechanical equipment. In spite of the rugged nature of the application, we expect a minimum of 5 years' service from the unit, and in all probability will replace it with an identical loader."

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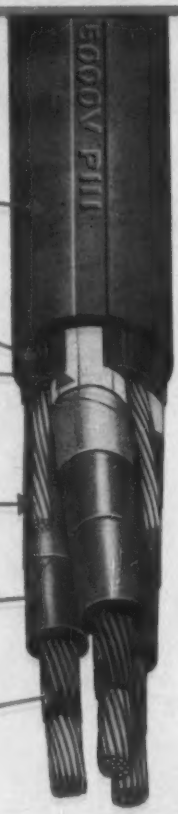


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Pride of workmanship, special design features and finest raw materials make the difference. But don't take our word for it. See for yourself. Let us show you samples and give you recommendations and details as they apply to your application. Write to Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

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# LW Haulpak®

## Moves more tons per man-hour

Here it is: the revolutionary LW Haulpak . . . introduced by LeTourneau-Westinghouse after more than 3 years of research, development, and field-testing. All new from the wheels up, Haulpak gives you highest output at lowest ownership and operating costs.

Haulpak gives you a hauler built to heavy *earthmoving* standards, not merely *automotive* specifications. Many parts and assemblies are identical to those used on thousands of jobs on famous LW Tournapulls®. With Haulpak, your maintenance, repair, and operating costs will drop to a new low . . . and your hauling tonnage will climb to new highs.

Detailed specifications are ready. Ask for them!

- 22, 27, 32-ton capacities
- 290, 335, 375 hp
- Haul up to 30% more than their own weight
- Need no springs, because they ride on Hydrair* (exclusive LW air-suspension system)
- Exclusive V-body for bonus-yardage within a short wheelbase . . . plus a low center of gravity for exceptional stability
- Non-stop U-turns in far less space than conventional trucks
- Powerful, twin 3-stage hoists lift body in seconds to 70° angle for fast dump
- Lube checks of just 4 grease fittings needed only at 500-hr intervals
- Exclusive LW power-transfer differential

Although brand new, Haulpak is fully field-tested. These machines have been put through rugged tests under tough working conditions for over 14 months — in mines, quarries, and on construction jobs. Here a Model 27 Haulpak gets a heaping load on one of its "test" assignments.

*Trademark HP-2098-G-1

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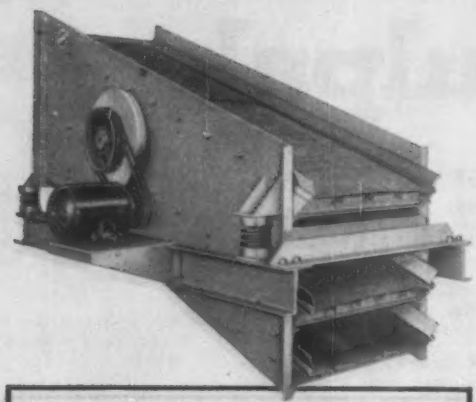
## gives you VIBRATING SCREEN CAPACITIES



Another Telsmith first—a handy, compact slide rule with all the factors needed to determine the capacity of any vibrating screen. It takes into consideration—(1) the kind of material to be screened; (2) size of screen openings; (3) percentage of oversize in the feed; (4) percentage of feed less than one-half size of screen openings; (5) whether top, second, or third deck; (6) shape of screen openings; and (7) screen slope. This slide rule gives you, in a few seconds, tons per hour per square foot through screen cloth and capacity of any size of screen. It will help you to pick and buy the most economical size of vibrating screens for your plant or mill.

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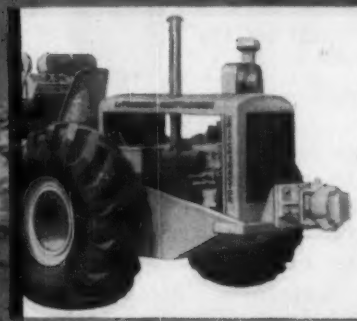
# Why use separate machines and operators on scattered tractor jobs?

Handle your widely-separated pit maintenance and clean-up jobs swiftly and economically with one man and a LeTourneau-Westinghouse Tournatractor®. Rubber-tired tractor speeds to the job under its own power . . . over RR tracks, paved roads, down shot banks, or cross country. There are no delays for load-and-haul to new locations.

LW tractor gives you better speed at the work area, too. Acceleration is fast, with 218 hp operating through sealed anti-friction drive. Maneuverability is quick and easy. Also, there's no loss of momentum to shift gears, because this tractor's gears are constantly in mesh. Even reverse action is *instant*.

**Handles wide variety of jobs**

You can use Tournatractor to clean around 2 or more shovels . . . to maintain stockpiles, level waste dumps, clean debris off RR tracks . . . to clean benches, handle shallow stripping . . . to tow air-compressors, or pull supply and service wagons. You can even use this speedy, mobile tractor for maintenance and clean-up in one or more adjoining pits.



With standard type E railway coupler — one of ten multi-service Tournatractor attachments available — this speedy, powerful tractor becomes a versatile off-track switcher, as well. Use it to spot and group rail-cars fast. Big tires on SwitchTractor† straddle rails, ride on ballast and tie-ends — deliver *double* the tractive effort of steel-wheeled switchers, rolling on smooth steel rails.

**Biggest tractor value today!**

In addition to giving you these plus operating advantages, LeTourneau-Westinghouse Tournatractor *costs less* than a track-type tractor of comparable horsepower. Let us demonstrate this rubber-tired tractor at your pit. Watch it perform under *your* working conditions. You'll find it can handle scattered tractor jobs faster, more efficiently, to help cut pit costs.

†Trademark CT-1865-MQ-1

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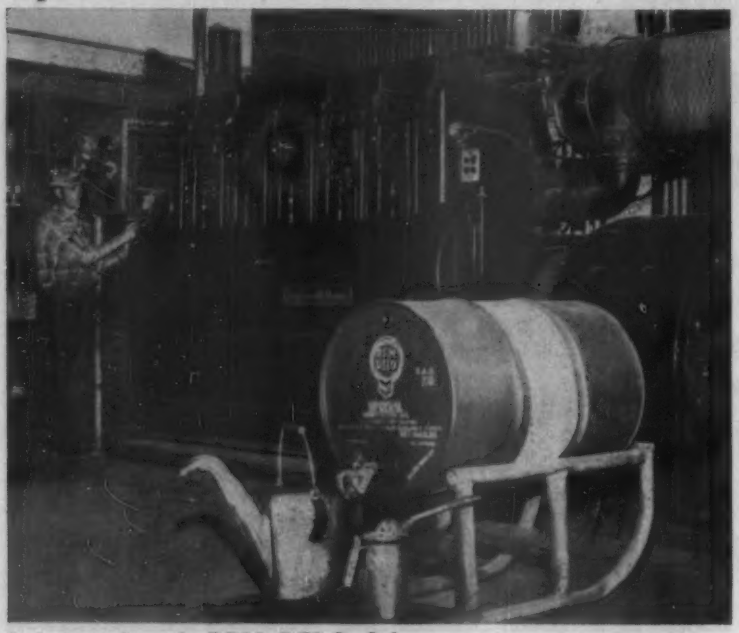
ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

PORTER BROTHERS CORP.

FIRM Bear Valley, Idaho

# Operates 7,000 hours without measurable wear



**Lubricated with RPM DELO Oil,** this 650-hp Ingersoll-Rand diesel is still in nearly new condition after three years' service. "We found no carbon sludge or lacquer when we tore it down last winter," says Power Plant Foreman Bill Niece (above). "And there was no measurable wear on rings, liners or bearings, though it had run more than 7,000 hours!" Engine is in power plant of Porter Brothers Corp. Firm dredges for strategic minerals under government contract.

**Trucks** hauling firm's ore work 'round the clock, 9½ months a year. Despite the tough punishment of carrying heavy loads over unpaved mountain roads, RPM DELO Oil keeps engines running smoothly, and eliminates excessive wear.

**Giant dredge** (left) processes nearly 6,000 yards of gravel every 24 hours. "Both this and our smaller dredge depend upon our diesel-generators for power," explains Superintendent Clay La Fon (right). "That's why we do everything possible to keep them running properly...and that includes using RPM DELO Oil. We've had excellent results with it in all our equipment...in our power plant, in our trucks, and in the tractors that level our tailings and restore the areas we've worked."

## Why RPM DELO Oils reduce wear—prolong engine life

- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists crankcase foaming

**For More Information** about this or other petroleum products or the name of your nearest distributor, write or call any of the companies listed below.

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# Cut mining costs thru better clean-up

There are only two ways to increase your mining profits without a rise in the price of ore. You must increase your production, or lower your operating costs . . . or both.

Here are 9 big ways a versatile modern high-speed grader can increase mining production and cut operating costs, to boost your profits.

**1. Regular, more frequent maintenance of haul roads** — Smooth roads speed hauling, save tire-wear, cut maintenance, improve safety.

**2. Quick clean-up after blast** — Grader provides a fast, inexpensive way to move scattered fragments back against toe, thus protecting tires, machinery, and men working around the pit . . . speeding up all pit operations.

**3. Clean pit floors** — Regular routine in maintenance of wide traffic ways makes all areas of the pit quickly accessible. Equipment can travel to any assignment by the shortest route. Smooth access pays off, saves wear on tires and crawlers, improves drainage, prevents dirt and refuse from weathering into levels of ore below pit floor.

**4. Maintain good housekeeping around plant** — You need ample grader capacity to keep roads, runways, working areas around plant neat, clean and workable at all times. Level or remove the occasional spill left by heaped trucks . . . from around hoppers, grizzlies, conveyors, and trestles. A clean plant area speeds all mobile equipment operation around plant, reduces dust, and improves safety.

**5. Keep stockpile toes pushed in** — Weather and loading operations result in spread of toes around stockpile. This limits working space, wastes stored material. Also, working thinly-spread toes means inferior ore grades, increased loading cost. Regular grader service helps prevent this waste.

**6. Keep dumps smoothly spread and level** — A level, dry dump speeds hauling, cuts equipment costs. Graders can spread dumped material clear over edge. Offset blade reaches far beyond leaning front wheels, which hold against side thrust. Grader can smooth haul road on the way to and from dump.

**7. Clean ore benches of washed-down dirt** — Every rain washes dirt into upper benches, lowers ore grade. Prompt grader service halts "wash", provides planned drainage, piles washed-in material for easy removal by scraper or truck.

**8. Assist exploration teams** — A modern grader can build a well-graded roadway in a matter of hours, can speed exploration work by maintaining good haul roads.

**9. Keep drainage open** — In a few hours per week, a modern grader will keep ditches clean, pit dry.

### Inventory capacity of your present graders

It will pay you to inventory the work capacity of your present graders. If they are more than a few years old, you will probably find a substantial saving in replacement with the faster, more powerful, big-capacity graders currently on the market. We will be glad to assist by furnishing specifications and comparative statistics on our L-W line of modern Adams* graders, manufactured by the LeTourneau-Westinghouse Company.

Reprints available on request.

Moving fast, this L-W model 660 Adams grader keeps pit floor clean, saving wear on fleets' tires and treads. Permits driving equipment by shortest routes, improves drainage.

This high-speed modern grader keeps haul roads in good condition to speed movement of haulers, reduce wear on tires and machines.

Occasional spill over sides of heaped trucks . . . around hoppers, grizzlies, conveyors, and trestles . . . can litter concentrating plant area, slow traffic, damage tires. Regular grader service speeds operations, saves on maintenance and repairs. *Trademark G-1812-M-1

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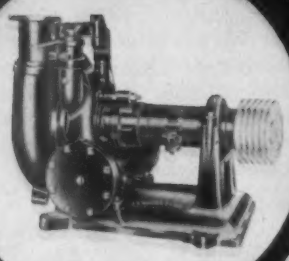

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# Air Pollution—Industry's Challenge

**JAMES W. FRANKLIN**
*Associate Editor*

IT HAS BEEN SAID that "man fouls his nest as few other animals do" as he constantly uses the soil, the waters and the air as a sewer. He is now faced with the cost that air pollution imposes upon society—$7.5-billion a year in the U.S. in terms of corrosion alone. Ten years ago, the average annual cost of air pollution was estimated at $10 for each individual. Today, the figure stands at $65.

U.S. industry spends from 5 to 10% of its annual capital investment on air pollution control, between $300- and $500-million a year. Yet, industry continues to get most of the blame for our present pollution problems, even though a recent survey by Armour Research Foundation reveals that industry is responsible for only about one-half of the trouble. U.S. Public Health Service says that more money must be spent on controls and abatement, that every dollar spent today on control will cut many dollars from the losses suffered tomorrow through depreciation, corrosion, damage suits against industry, lost man-hours, illness and death.

The problem is by no means just a domestic one. A British authority in a recent issue of UNESCO's official organ THE COURIER, describes the

**Howard F. Roderick,** vice president, Phosphate Chemicals Div., International Minerals & Chemical Corp., Bartow, Fla.*

"Let me say that a soundly directed scientific research for the real facts on air pollution will attract industry's whole-hearted participation. Industry has two compelling reasons to contribute to such a program—an increasing need to openly demonstrate the regard for its responsibilities in this area, and its profit requirement (practically everything that is carried off in the air stream represents a loss to industry). For its own part, industry needs to organize its pollution research and control efforts, which are costing millions of dollars a year, so that these become a massive movement toward a permanent solution. Having taken this step, industry needs to inform the people of its progress. When it does, it gains an understanding ally."

problem in the following words: "Since the beginning of the industrial revolution, a minor irritation has become a great social evil. In towns and industrial districts, rain water loses its purity; ash and other solids fall continuously to the ground; the air contains a suspension of fine particles which penetrate indoors to be deposited on walls, ceilings, curtains and furniture; our clothing, our skins and our lungs are contaminated; metal corrodes, buildings decay; and textiles wear out; sunlight is lost; germs multiply; our natural resistance to disease is lowered. In a hundred and one ways, the miasma of atmospheric pollution is lowering our vitality and our enjoyment of life." Every year in Britain, 200-million tons of soft coal and 20-million tons of oil are burned, producing 2.1-million tons of smoke, 5.3-million tons of sulphur dioxide and 24-million tons of carbon monoxide, in addition to considerable complex organic and inorganic compounds. From THE COURIER we also learn that other nations are feeling the effects of our industrial growth:

* Mr. Roderick is now president, Chemical Div., Miles Laboratory.

**In the Soviet Union,** scientists are worried about the effects of the rising use of the automobile in major cities. Research is being conducted on the effects of sulphur dioxide on the human organism—the gas can be smelled when its concentration is above 1.6 mg/cubic meter, yet Soviet scientists report that as little as 0.6 mg can provoke reflexes in the brain.

**Switzerland** notes that harmful effects on animals and plant life have been reported in industrial communities.

**Poland says** that in some districts, where the concentration of smelting and similar industries are particularly heavy, the health of school children is being adversely affected.

**Netherlands reports** that pollution from fluoride compounds has had such a harmful effect on cattle that some have had to be slaughtered. Damage to plant life has also been reported.

**Germany lists** animal losses in the vicinity of plants releasing arsenic compounds and metallic dusts into the air.

**Sweden says** that harmful effects on plant life have been observed as a consequence of flue gases from shale-oil processing factories, iron works, phosphate facilities, carbon bisulphide plants, copper works, electro-chemical and sulphate cellulose factories.

**Finland notes** that heavy compensation has been paid by a sulphuric acid producer for damage to crops and materials.

**Mexico**—even in the tropics, the problem exists—says that visibility in Mexico City on a fine day has dropped from 10-20 kilometers to 3 or 4 since 1940.

**In the U.S.,** a definite dollar-and-

**Herman E. Hilleboe,** commissioner, New York State Dept. of Health

"We no longer can take clean air and clean water for granted. Just to recognize but a few of the losses [suffered] is to see a vital need for industry to assume an important role in the task of reducing air pollution and preventing it in the future."

## Public Health's Viewpoint—Surgeon General Leroy E. Burney States the Case

WE ARE WITNESSING a dynamic transition in our environment. The new world we are creating — higher standards of living, more comfortable, safer from communicable disease — brings with it new problems which will not wait for leisurely solution. They demand immediate readiness on the part of persons representing a great variety of disciplines and skills, a readiness based on mutual knowledge and mutual confidence.

Air pollution is one of these problems. On this problem I can report on the current status of the Public Health Service program in air pollution, after approximately three years of operation under Public Law 159 of the 84th Congress—what we have done and what we have learned.

Public Law 159, enacted by Congress and signed by President Eisenhower in 1955, is in itself a manifestation of what I consider the most significant single fact in the air pollution picture—the rising tide of public interest in the quality of our nation's air. Until a few years ago, air pollution was almost exclusively of interest to the professionals in the field.

As of today, the problem has emerged into public consciousness from coast to coast. This has been sparked by the development of acute situations and the growing realization of the increasing potential for air pollution in our cities. The recent action by the Governors' Conference in calling for a report on various types of State legislation available for adoption, and the recently expressed interest of the Conference of Mayors, indicate that our highest officials at the State and local levels are feeling this increase in public awareness. In the past two years, 11 differ-

***According to calculations of air-pollution engineers, if all the dirt that accumulates in the air above an average city in one year were to settle to the ground at one time—the city would be covered by a 21-ft avalanche!***

cents cost is placed upon air pollution by plaintiffs who sue industry for damages which they believe they can prove to be directly due to air pollutants. Even though these suits are sometimes settled for less than billed, the cost to industry annually is tremendous. In Oregon, not many years ago, about 100 farmers sued a company for several million dollars. The settlement was much less, but the company had to spend $2.5-million for control equipment to avoid further suits.

A survey of the papers and speeches from several recent seminars are presented on these pages. At the National Conference on Air Pollution, in Washington, D.C. in November 1958 the first-hand opinions expressed here were gathered. The mining industry was represented at the conference by 28 companies, the AIME and E&MJ. Mining men came away from the final session unanimous in the knowledge that industry, and the mining industry in particular, must do a better job of telling the general public what it has done in the past and is doing today to prevent air pollution, or face the consequences.

Local, state and regional pollution control regulations are getting tougher and the officials more vociferous. No longer are they concerned only with smoke, soot and grime. Legislation is being enacted that will make it difficult for some industries to stay in some areas. This tougher attitude on the part of pollution control officials has gotten around to including the farmer, the motorist and the housewife, all equally guilty, as sources of air pollutants.

Why?

There has been a sudden realization, born of years of painstaking research into epidemiology—the study of illness based on population trends rather than on individual cases—that the air we breathe is, or may be, responsible for many of modern man's ills. Lung disease, the cancers, certain heart ailments and gastro-intestinal ailments seem to be more prevalent in highly polluted industrial areas. Furthermore, investigations of several major air pollution catastrophies clearly indicate that bad air, the "malaria" of the Middle Ages, is still with us today.

With Surgeon General Burney's speech, part of which is reproduced below to illustrate Public Health Service's viewpoint, a three-day session on the What's, Why's and Wherefore's of air pollution control and abatement got under way. It wasn't long before it became apparent to industry representatives that industry had better start telling the general public what industry has been doing and is doing to prevent, control and abate atmospheric pollution.

Three important industrial-community air pollution episodes were discussed in detail at the conference. One was that of Meuse, Belgium, 1930. Another was Donora, Pa., 1948 and the third was London, 1952.

These three localities and the disasters that struck without apparent warning had many things in common: there were anti-cyclone weather conditions prevailing; thermal inversions; dense fog; vast amounts of particulate matter in the air, mostly carbon and iron; vast quantities of various oxides of carbon, sulphur and nitrogen; the particulate matter in the air had absorbed a great deal of gaseous acids on its surface. In each episode, the concentration of no single chemical substance ever reached a recognized toxic level. No single cause of illness or death could be given. All illness and death ceased immediately when it began to rain.

**The Meuse incident** took place in

**Dr. Jerry McAfee,** vice president, Gulf Oil Corp., Pittsburgh, Pa.

"Enforcement of air pollution control laws under a permit system—as practiced in Los Angeles—requires air pollution control before it is proved that such controls are necessary. On the other hand, an injunctive system, based on civil action, prevents the needless expenditure of funds for costly controls until it is shown that a pollution problem really exists."

ent states have passed initial laws or strengthened existing air pollution legislation.

Unmistakably, the informed people in our nation are no longer taking for granted the air we breathe. They are rejecting the old maxim that a prosperous city is necessarily a dirty city. However, in only a few places has this attitude been accepted by the public to the extent that it has demanded preventive actions. The public as a whole still needs to ask several searching questions about air pollution. What is it doing to us? What is it costing us? Just how inevitable is it?

Above all, the people should ask what it is doing to their health. President Eisenhower, in his special health message to Congress in January 1955 struck the keynote when he said: "As a result of industrial growth and urban development, the atmosphere over some population centers may be approaching the limit of its ability to absorb air pollutants with safety to health."

We need not look for nation-wide epidemics from air pollution. We have been alerted by severe outbreaks both within industrial establishments and in community-wide smogs under certain atmospheric conditions. And now, after several years of closer observation, investigators are finding a definite association between community air pollution and high mortality rates due to cancer of the respiratory tract, including the lung, cancer of the stomach and esophagus, and arteriosclerotic heart disease.

In addition to these more serious problems of personal health, we are confronted now with many troublesome manifestations of air pollution—acute nuisances, plant damage, reduced visibility, odors and growing economic blight.

The law directs the Public Health Service to conduct and support research and to provide technical services to State and local governments and to private agencies. All of our activities in the air pollution field can be classified under these two headings of research and technical services.

In an area so vast, complex and relatively unexplored as air pollution, the greatest need has been to learn. Consequently we have devoted a great majority of our resources—about 80% of the $12.5-million thus far appropriated—to research. The remaining 20% of our budget supports activities classified as technical assist-

**Gen. John E. Hull,** USA (Ret.), president, Manufacturing Chemists' Association, Inc., New York, N. Y.

"The fundamental attitude of the chemical industry toward air pollution is . . . Pollution of the atmosphere, to the extent that it creates a nuisance or has a detrimental effect on the health or on the property and its utilization, shall be unlawful . . . Responsibility for the means of correction or avoidance of emissions shall be the responsibility of the owner or operator—these statements are embodied in the MCA publication 'A Rational Approach to Air Pollution Legislation'."

the first week of December 1930, when all Belgium was covered with a dense fog which was particularly heavy in the Meuse Valley. In a 15-mile area there were many coke ovens, steel mills, foundries, blast furnaces, zinc plants, power stations, a fertilizer and sulphuric acid plant. All of the homes in the area were fired with coal as were all the ships and trains. On the third day of the thermal inversion, people began to fall ill of an unidentified respiratory disorder. Over 6,000 became ill; about 60 finally died.

**The Donora episode** occurred in the last week of October 1948 with static air, fog and an inversion. Heavy industry in the valley included steel mills, blast furnaces, a zinc plant (since closed, to the relief of the local residents) and sulphuric acid plants. Again by the third day, people became ill, 5,910 in all; 18 or 20 died.

**In London,** the major episode occurred in a dense fog that covered the British Isles Dec. 5 to 9, 1952. Mortality rate studies show that 2,500 more people died during the period than did in a normal no-fog week of previous years.

The nature of the disease processes in all three episodes were similar. Onset was abrupt in healthy individuals, and the increase of symptoms of the chronically ill was sudden and without apparent cause. There was burning of the eyes, nose and throat followed by coughing, shortness of breath, constriction and burning in the chest, wheezing, nausea and vomiting, and in the seriously ill, collapse and death.

**Other episodes,** to add their weight to the evidence—Cincinnati; Poza Rico, Mexico; Yokohama, Japan and Los Angeles—were detailed in speaker's papers.

A recent survey of New York State shows that 39 out of 40 cities with a population over 25,000 have a serious air pollution problem. Three-fourths of all the communities in the state with populations between 5- and 25,000 have some kind of problem. One-third of those under 5,000 population are in trouble.

Perhaps the most serious problem facing the U.S. today (tomorrow the big problem may be radiation pollution) is that created by the internal combustion engine discussed below. The medical implications, the case for cancer, the particulate problem and national trends in the field of air pollution, as discussed at the national conference, are presented in the following pages.

## Internal Combustion Engines

IN MANY METROPOLITAN CENTERS, the automobile has become the most important single contributor to air pollution. In 1940, there were about 32-million cars on the road; in 1957, there were 67-million; by 1975, there will be more than 100-million. In 1957, automobiles consumed a little over 1.33-billion barrels of gasoline; by 1975, the figure will have climbed past the 2-billion barrel mark. Automobile exhaust pollutants stand head and shoulders above any other type today—two-thirds of all the pollution in the atmosphere above Los Angeles County is directly attributed to the internal combustion engine.

These estimates of pollutants were

**D. A. Irwin,** medical director, Aluminum Co. of America, Pittsburgh, Pa. (MCA, 1958)

"An industry contributing only inert, non-toxic fine micron or submicron particulate matter to the air may be just as responsible for the adverse health effects—acute illness and death—in an acute episode of community air pollution, as the industry contributing small amounts of toxic gas, vapor or mist; although singly these materials would cause no adverse effects."

**"Cities with the heaviest pollution loads tend to rank high in death rates. . . ."**

ance, including consultation services, assignment of personnel on request to help with specific problems, demonstration and training projects, and others.

It would not be possible for me to describe in detail the many research projects presently underway with Federal and other support. I shall attempt only to indicate the broad general lines along which investigation is proceeding.

The goal of research on the health effects of atmospheric pollution can be simply stated: to determine the conditions under which toxic substances in the community atmosphere affect human health adversely, and the measures which must be applied to prevent adverse health effects.

But with this statement of purpose, simplicity stops. The investigator is confronted by a seemingly infinite variety of polluting materials, reacting in the giant test-tubes of air above our cities. Also, he is searching for effects, not in relation to one disease with one specific cause but rather in relation to a larger number of diseases, of multiple etiology, many of which are not in themselves clearly understood.

Medical research in this field includes both epidemiologic and laboratory studies. Comparing mortality and morbidity data with various indices of air pollution, we are finding interesting parallels — cities with the heaviest pollution loads tend to rank high in death rates for a number of diseases.

The relationship of cancer to atmospheric pollution, for example, is being explored. We know that cancer-producing agents are in the air we breathe. Cancers can be

made for Los Angeles County, where 2.7-million registered vehicles use 5.5-million gal of gasoline a day: every 1,000 gal of gasoline consumed releases 1.5 tons of pollution (about 3.5 tons per 1,000 cars per day); an additional 40 tons of gasoline evaporates from the fuel systems each hour on days when the temperature is in the 95- to 100-deg range; 0.007% by weight of the exhaust is in the form of salts of phosphate, sulphate, chloride, nitrate and oxide of barium, iron, calcium, lead, zinc, potassium and lithium.

Of the hydrocarbons found in the atmosphere on any given day—about 1,450 tons—automobiles are responsible for 52% of the total, trucks and buses another 17%. Automobiles are responsible for 62% of all nitrogenous oxides, 75% of the carbon monoxide and 9% of the oxides of sulphur found in the air! About 75% of the sulphur compounds in the air come from fuel oil- and gas-burning heating equipment.

***The old adage "what you don't know won't hurt you" doesn't apply to air pollution—most of the particulate matter and fume escaping from the seemingly clean stack is smaller than the visible range. It is this fume, and fume condensed on small submicron particulate matter, that worries the air-pollution researcher.***

**Arthur Crago,** manager, Florida Phosphate Div., American Cyanamid Co., Brewster, Fla.

"If we face our problems honestly and realistically we will come to the conclusion that in each community, everybody is guilty of air pollution and that today, when we correct this problem, it may hurt me; when we correct that other problem tomorrow, it will hurt you. I think we need to have education in the community that gives people a general picture of the whole problem so that we can use good judgment in making up our minds about—

What kind of air do we want, what kind of air must we have and what kind of air can we afford."

Attempts are being made by the automobile industry to solve the exhaust problem—and these are just in time, since the Hon. Edmund G. Brown, Governor of California, recently signed a bill that requires the state director of public health to establish permisible levels of auto exhaust emission. Once these standards are set, officials can (and will) bar the sale of any vehicle that does not meet the standards. In the spring of 1959, Chicago passed a law that places a heavy fine on motorists operating vehicles with dirty exhausts. The city of Philadelphia has added perfume to diesel fuel on bus lines. Cleveland is testing an odor-masking additive on 199 diesel buses. At least two major auto producers will have catalytic exhaust scrubbers on 1960 automobiles.

Diesel engines, properly operated and maintained, produce a minimum of pollutants, as is attested by their approved use in underground mines. Carbon monoxide is a toxic constituent of the exhaust of the internal combustion engine, and in certain instances may constitute a dangerous health hazard. Oxygenated products in the exhaust produce annoying odors and smoke that reduces visibility and generally soils the surroundings. The hydrocarbons and oxides of nitrogen form, in the presence of air and sunlight, aerosols which are responsible for the Los Angeles type smog. Aerosols do great damage to crops, irritate the eyes and increase the amount of ozone present—ozone is known to cause structural changes in the lungs and respiratory tracts of test animals.

While it may seem that smog is the particular problem of Los Angeles, it is not. Any urban community or valley town with a high vehicle density and poor natural ventilation can become smog-bound.

## The Medical Implications

ALL OF US who were born, raised or still live in industrial communities (particularly valley towns along rivers surrounded by high hills) are potential victims of another Donora, Meuse or London. The problem of air pollution belongs to everyone. Normally, on a clear crisp day, the prevailing wind will blow away the pollutants above a community, or at least dilute them. Rain washes out the gases, some dust produced in animals using concentrates of urban smog. We know that lung cancer death rates in the largest cities are twice as high as those in non-urban areas. The case has not yet been proved, but the weight of circumstantial evidence grows heavier as research progresses.

A follow-up study on the population of Donora, Pa., where a week of smog in 1948 caused 20 deaths and widespread illness, shows that the people who were made ill by the smog, in general, have had poorer health and higher mortality rates these past 10 years than their neighbors who were unaffected by the episode — this, even though air pollution in Donora has been substantially reduced.

Laboratory experiments are yielding significant information on a number of specific pollutants which occur in community air. One of these, ozone, causes scarring of the lungs in animals which breathe it in sub-lethal doses over a period of months. Other experiments indicate that ozone may have an effect on the enzyme system as well as the respiratory tract and that aerosols aggravate the harmful effects of sulphur dioxide. It has been proven also that sulphur oxides, in concentrations sometimes found in community air, make breathing more difficult for human beings.

The National Air Sampling Network is now approaching a coverage worthy of its name. This plan for systematic measurement of air pollution depends upon the voluntary action of States and cities. Since Jan. 1, 1957, the cooperating agencies have been using uniform sampling methods. At present, 180 cities and 51 non-urban areas have sampling stations, all manned by State and local personnel. Every State and Territory has at least one urban and one non-urban sampling site. The Public Health Service has provided the equipment, established the procedures, and is analyzing the samples. It is important to note that seven States have established their own sampling networks giving more intensive coverage than the National Network is equipped to do.

Thus far the National Network measures and analyzes only particulate matter — solid particles and liquid droplets in the air. The need to include measurements of gaseous pollution is recognized, and will be met as technical and economic problems are overcome.

**Dr. Chauncey D. Leake,** ass't dean, College of Medicine, Ohio State University, Columbus

Here [nuclear weapons testing] is a subtle, not easily seen, but potentially very dangerous sort of air pollution, involving all living things, now and to come."

**Louis C. McCabe,** president, Resources Research, Inc., Washington 16, D. C.

"The effect of the more common atmospheric pollutants upon the general health of the population of our urban and industrial centers has not been demonstrated in the form of authenticated chronic disease processes. The complexity of the problem is such that further evidence must be sought before the hazard to public health can be appraised adequately."

and fume, and the heavy particulate matter settles over a large area.

However, the masses of air that range about the globe are subject to local conditions. Frequently, at night along rivers in the temperate zone, the temperature of the upper air becomes warmer than that on the ground level. This is a thermal inversion, acting as a lid on the community, preventing the dissipation of pollutants. Waste products begin to build up in the smog banks so familiar to airline passengers at dawn or dusk. If the wind dies down and if it does not rain, the static conditions can last long enough to bring on an acute air pollution episode, as they have in the past.

Under normal conditions, a toxic gas, fume or gas-coated particle can be present in the air in concentrations that will not cause harm. The concentration might increase until it begins to irritate, but still do no harm. At still higher concentrations, perhaps at the beginning of a thermal inversion, the toxic materials may reach such a level as to make the unhealthy ill. As the thermal inversion continues, the seriously ill and the weaker may die. If conditions continue to get worse, the toxic materials can reach such a level that healthy persons are killed.

Fortunately, the onset of the last condition has been prevented in the major episodes by the coming of the wind and rain.

Two things are clear. One is that chronic, sometimes fatal diseases result from exposure to environment. The other is we are learning that many of the environmental conditions to which man is exposed only gradually reveal themselves as dangerous to health. Chronic diseases are so insidious in their onset and the causative mechanisms so subtle that decades may pass before cause and effect can be related. For example:

**Coal miners' pneumoconiosis**—a disease in which scar replaces the normal lung tissue—may result in the death of the individual. For many years it was considered that coal dust, while dirty and even causing certain physical changes in the lung structure, did not seriously effect health. However, recent British studies show that coal dust does cause extensive disease in many persons and may be the cause of death. Coal miners over 40 years of age, who have the disease in an aggravated form, suffer a 50% or more loss in lung function. Even miners without clinical evidence of the disease show somewhat impaired lung function.

**Silicosis** is no stranger to the industry, and its treatment and prevention are now standard practice—but it was not always so. Silicosis is produced through prolonged inhalation of dust containing a high percentage of free silica.

**Emphysema,** the loss of elasticity in the lungs, is a common complaint in the cities of the British Isles afflicted with polluted air. Emphysema is the end result of a disease which gradually enlarges the tiny air sacs in which oxygen is exchanged. These sacs, because of chronic obstruction in the pathway of the lungs, become larger and confluent, and ultimately

***U.S. citizens use 300-million gallons of paint every year, but cannot keep pace with corrosion, much of it due to air pollutants. The cost of corrosion, in rusting metal alone, has been estimated at $7.5-billion a year by the paint industry.***

## "The role of the automobile engine as a source of pollution is under study."

We recognize that a country as large as our requires much larger resources than are available at the present time to sample and analyze air pollution on an adequate scale. The National Air Sampling Network is a good foundation for future expansion and refinement.

The Sanitary Engineering Center at Cincinnati is conducting many other studies in the engineering and physical sciences. They deal with measurement of pollutants at the source, behavior and dispersal of pollutants in the atmosphere, their various effects on vegetation and structural materials, and methods of control. The role of the automobile engine as a source of air pollution is under study. Some of our most valuable work is being done in improvement of equipment for continuous monitoring and in refinement of analytical methods.

The Public Health Service is collaborating with other Federal and non-Federal agencies in research areas. For example, the U.S. Weather Bureau is clarifying the conditions of dispersal of pollutants, and has improved the accuracy of prediction of air pollution build-ups. The U.S. Bureau of Mines has developed and applied methods of analyzing automobile exhausts.

A project now underway in Nashville, Tenn., combines medical and engineering studies in a manner which may establish a pattern of future investigations. We are studying air pollution levels in various parts of the city by intensive sampling, and at the same time conducting an epidemiologic study based on place and duration of residence within the city. Among the health data recorded are cause and frequency of mortality, incidence of various diseases, and

much of the air space in the lung is "dead." Lung function is thereby reduced, sometimes to the extent that either a slight infection or some extra load on the heart (which must compensate in part for the lung failure) will result in death.

Emphysema is common in England. It is becoming more common in the U.S. In California, the death rate due to emphysema has risen sharply in recent years—from 1.5 in 1950 to 5.8 per 100,000 persons in 1957. In cities the rate is twice that of rural. The case against air pollution is not clear-cut; but the evidence is weighty. Dr. Hurley Motley found that some persons with severe impairment of lung function, when taken out of polluted Los Angeles air into a room where the air has been filtered through activated charcoal, showed decided improvement in lung function.

**Asthma has been related** to air pollution. Yokohama asthma is the name given to a disorder recognized among U.S. servicemen and their dependents in the winter of 1946 in Yokohama, Japan. The previous year, many personnel experienced a mild bronchitis; in 1946 they had attacks typical of asthma. Most of those afflicted had no record of allergy. Attacks occurred during a period of low wind and high air pollution. The Japanese also noted these symptoms. In a series of experiments, human volunteers were exposed to sulphur dioxide and sulphuric acid mists. Two volunteers developed increasing sensitivity to the substances. One developed a persistent bronchitis which progressed to the point where wheezing and coughing developed upon exposure to either reagent. The other developed wheezing symptoms which continued for four days after removal of the substances—the resemblance to cases at Yokohama is believed close enough to warrant further study.

**Chronic bronchitis** is the most serious complaint recorded in the British Isles with much higher incidence in urban than rural areas. A study shows that the incidence of the disease rises sharply as one goes from a relatively clean rural area toward the center of industrial, highly polluted cities. Four major smog epidemics have occurred in London since 1948, each followed by a rise in the death rate when compared to the average mortality of fog-free periods in previous years. Nearly 600 excess deaths were recorded after the fog of November 1948; 2,500 after the fog of December 1952; 500 after the fog of January 1955; and 400 after that of December 1957.

If deaths in excess of normal for the towns surrounding London were included in these figures, the totals would double. Those persons most severely affected were the very young, the elderly, and those already suffering from lung and heart disease. Epidemiological studies show that for the general population between age 45 and 65, the death rate is significantly related to visible fog, population density and domestic overcrowding.

There are no similar bronchitis episodes in the U.S. due to a possible difference in the manner in which the disease is recorded, but mainly due to the differences in the air pollutants in the two nations. About 30% of U.S. electric power is derived from coal with another 60% from petroleum products. In England, 95% of all power and heat are derived from soft coal.

There are also significant differences in housing and social conditions which might affect the incidence of the disease. In England, urban death rates from bronchitis are twice as high for men and women as compared to rural. In the U.S., urban rates are only 12% higher for men over rural, and insignificantly higher for women.

No specific cause has yet been proved for bronchitis, but in both countries, the implication is there—case histories show that chronic

**Arthur S. Flemming,** Secretary, Dept. of Health, Education and Welfare, Washington, D. C.

"There is no question that society is going to have to make a real investment if the problem of air pollution is going to be handled . . . The only way to make progress is to translate our convictions into dollars."

**Dr. Herbert C. McKee,** manager, Air Pollution Research, Southwest Research Institute, San Antonio, Texas

"In a truly community-wide problem, the atmosphere gets in such a mess that frequently it is impossible to distinguish one pollutant from another, or to tell where each comes from."

presence of carbonaceous dust in the lungs. Thus we are attempting to pinpoint pollution's effect on people's health where they live.

Control of air pollution demands not only additional knowledge through research but also more adequate resources, both in personnel and in material, at State and local levels. The Public Health Service has initiated action to help fulfill these needs. We receive many requests for technical assistance, ranging from limited consultation to large-scale participation in projects such as State and municipal air pollution surveys. We meet these requests to the extent of our capabilities, and supplement direct assistance by means of grants for demonstration projects.

Training courses are offered by the Sanitary Engineering Center, both in Cincinnati and in the field. More than 900 persons took part in these courses during fiscal year 1958, and the total for 1959 should be considerably higher. Interestingly, personnel from industry make up a higher percentage of the enrollees each year. It is encouraging that at least 14 universities are now offering graduate courses for advanced degrees in subjects related to air pollution, most of these having been established with Public Health Service grants.

I should like to return to the broader problems of environment and health, of which air pollution and its control is one part. A few minutes ago, referring to the circumstantial evidence relating cancer to atmospheric pollution, I remarked that the case has not yet been proved. This legal metaphor is frequently used. I submit to you that it is misleading.

In law, the subject is innocent until his guilt has been proved beyond reasonable doubt. In the protection of human health, such absolute proof often comes late. To wait for it is to invite disaster, or at least to suffer unnecessarily through long periods of time.

Many years ago, before anyone had seen a germ or positively identified a single causative agent of epidemic diseases, far-sighted leaders observed the association between epidemics and filth. Wherever they had sufficient foresight to act on this circumstantial evidence, they made striking progress. Cleaning up the city filth resulted in better health. Years later they found out why.

**William R. Bradley,** ass't director, Environmental Health, American Cyanamid Co., N.Y., N.Y.

"There are two contributors [to air pollution]—the general public and industry. Both groups must come to realize that they are contributors in all categories and, quite likely, in almost equal proportions . . . The majority of industrial managements have demonstrated their cooperation for cleaner air and consider that properly constituted and fairly administrated control legislation will serve as a spur to those who may be recalcitrant . . . It is not accurate to say that all air-pollution-abatement systems result from conformity with air-pollution control regulations. Rather, many advances have grown out of the realization on the part of industry that pollution of the air, whether unpleasant to smell, irritating to the eyes, damaging to crops or haze-producing, is not proper and sooner or later must be met . . . there are thousands of examples where air pollution abatement has been put in without any return on investment, without the motivation of a return or the development of a by-product . . . The dollars spent for air-pollution abatement motivated by a sense of doing the right thing far outweigh the dollars that have so far been spent for economic returns."

bronchitis sufferers are made more ill by increasing levels of air pollution.

**Pneumonia.** Co-incidentally, while studying chronic bronchitis mortality rates, the British workers found that the death rate for pneumonia is significantly related to visible fog and population density.

## The Case For Cancer

SENSATIONALISM is not the purpose of this article, and it is difficult to treat the subject of cancer without being accused of creating scare headlines. Cancer must be considered in any discussion of air pollution, for many facts stand out:

**One** — cigarette smoking, while shown to be a possible cause or contributor to lung cancer, cannot explain all cases of the disease.

**Two**—lung cancer rates are 100% higher in urban areas over rural, even where there is no significant difference in smoking patterns.

**Three** — there is little significant difference in urban vs rural death rates from cancer for white women, but there is a significant difference for urban white men over rural, indicating that white males are either more susceptible to the disease;—or subjected to an environment not common to white females, such as in-plant conditions combined with community.

**Four**—epidemiological studies show parallels between air pollution levels and mortality rates due to cancer of the stomach and esophagus similar to those already found for lung cancer. We know that a sizeable amount of pollutants are swallowed during the normal course of the day. Many of those who were made ill in the famous episodes mentioned earlier reported severe gastro-intestinal symptoms.

**Five** — carcinogenic (cancer-producing) materials have been identified in the air in a particulate state that permits their being breathed and deposited on the lining of the lungs where the cancer-producing materials may be released to gain entrance into the body. Many of the cancer-producing agents are chemically stable and as such, they survive sufficiently long after emission from the source to be potentially biological threats to health.

**Six** — concentrates of cancer-producing chemicals taken from polluted air have produced tumors in experimental animals.

**Seven**—atmospheric irritants of all types, such as aldehydes and organic acids, though in themselves non-

***The U.S. public spends $3-billion a year on laundry and cleaning bills with a disproportionate share being paid by the urban dweller who must change shirts twice a day, clean curtains every week or so, and paint the walls once every year.***

## "Air pollution respects no boundaries, geographical, political or professional . . ."

I suggest that our present position in respect to contemporary health problems, especially those relating to the urban environment, may be parallel to that of Pasteur's predecessors.

The City is the great sociological fact of mid-century American life. All of us have seen the population statistics. All of us have read the predictions calling for gigantic super-cities in the immediate future: a solid urban complex from Boston to Washington and perhaps from Portland to Norfolk on the Atlantic seaboard; a similar unbroken mass from San Diego to San Francisco on the Pacific; a third megalopolis along the southern shores of the Great Lakes [Buffalo to Chicago].

Another index of our growth is the increase in our national output. The gross national product is doubling every 17 years, an almost unbelievable acceleration spurred by an $8-billion annual investment in research. And the more we produce, the more problems we create in terms of wastes to be disposed of safely.

## Our Changing Environment

Finally, and perhaps most significantly of all, our new world differs from the old not only in degree but also in kind. Today we are dealing with processes and products which were unheard of prior to World War II. In ten more years, still more new substances will have been added to our environment. I need only refer to a few examples — the petrochemicals and other synthetics, the soaring future of uranium and high energy fuels.

carcinogenic, may play a role in the development of cancer by interfering with the normal flow of the mucous stream that permanently resides on the cells lining the lungs. It is this continual flow of mucous that normally serves to prevent the accumulation of material in the lungs. Irritants, particularly positive ions, reduce the activity of the cilia, the propelling whips that move the mucous stream out of the lungs toward the nose and mouth, so that particles begin to accumulate in the lungs. Proteins in the blood and body cells are capable of freeing the cancer-producing chemicals attached to the particulate matter.

**Eight**—the irritants may come from specific occupational environments, from smoking, or from the specific biological reaction to repeated viral or bacterial infection. But atmospheric pollution uniquely supplies all the links necessary for the experimental induction of cancer.

**Nine** — the death rate throughout industrial urban areas is on the rise in the case of such cancerous diseases as leukemia, Hodgkin's disease, lung, ovary, pancreas, bladder and kidney cancer.

In the absence of contrary evidence, these facts, coupled with epidemiological characteristics of cancer, strongly suggest a similar action in man. Dr. T. F. Mancuso put it this way ". . . I believe that air pollution represents a highly probable and important factor in the excess of lung cancer in urban areas, acting directly and augmenting the occupational exposures of men so that carcinogenic and co-carcinogenic agents of both environments may be involved."

**Dr. Leslie Silverman,** School of Public Health, Harvard University, Boston, Mass.

"There are plants on the coast that operate on a ship captain basis. I know of one large smelter that for years has operated on the basis that when the wind blows to sea they let the $SO_2$ go; when the wind blows toward town, they make acid . . . When the market was good they made acid all the time, but now that the market is bad they let the $SO_2$ go to sea. They're fortunate because dilution is pretty well assured, but not too many industries are in that position."

## The Particulate Problem

SULPHUR OXIDES make breathing difficult, even in concentrations found in polluted air. Ozone scars the lungs of test animals and produces pulmonary edema (excess fluid in the lungs). The ingredients of Los Angeles smog, suspected of being eye irritants, produce damage to the tissue of test animals when applied or injected in concentrated amounts.

The irritants are made all the more hazardous by the presence in the air of suspended solids or liquid particles (aerosols) to which they can cling. This is a major concern of the medical profession—toxic materials in gaseous form may be transferred directly to the body through their attachment to particulate matter which is inhaled.

Water-soluble gases inhaled by humans are removed rather rapidly in the upper respiratory tract by the moist mucous lining. Large airborne particles, plus five microns, penetrate into the lower tract and may reach the air sacs. About 15% of the minus one micron material inhaled is retained temporarily in the air passages and sacs. About 1% is retained more or less permanently.

Thus industry must consider all the contributions it may make to community pollution—its toxic gases, vapors, mists and particulate matter, particularly the fine invisible submicron dust, fume and aerosols.

**Dr. Chauncey D. Leake**

". . . If air pollution is successfully to be reduced, we all have to get busy and actually do something about it; or else we are all going to continue to suffer from it."

## Our Nation Is Getting Dirtier

AT THE TURN of the century, air pollution was already a distressing problem in Chicago, St. Louis, Baltimore. When soft coal replaced anthracite for home heating during World War I, New York, Pittsburgh and Philadelphia began to suffer.

This, then, is the new environment we are creating. Are we ready, as professionals and administrators, to solve the problems it produces?

"The wind bloweth whither it listeth." Air — and therefore polluted air — respects no boundary lines, geographic political, professional, or disciplinary. In our common struggle against air pollution, are we as flexible as the enemy? Here and there, yes.

## Can We Afford Clean Air?

Cities are banding together to form county-wide air pollution control districts. Counties are merging their resources where it is evident that they can be more effective by doing so, as in the San Francisco Bay Area. The Interstate Sanitation Commission covering the metropolitan area of New York City demonstrates that State governments can plan and act together. Work between U.S. and Canada in the Detroit-Windsor area is a fine, but little-known, example of international cooperation in the interest of human health and well-being.

Can we in the U.S. be equally flexible in regard to the less tangible but sometimes more stubborn boundary lines that separate profession from profession, special interest from special interest? I believe that we can.

The problems that come as by-products of our almost unbelievable material progress demand everybody's skills and knowledge. More than that, they demand genuine cooperation. We can no longer ask "Who's going to be in charge?" or "Who's going to get the credit?" We must ask "How can we most effectively work together?" Nor can we ask "Can we afford to clean up the air?" We cannot afford not to! It costs cities more to endure dirty air than to apply the controls we now have. Controlling air pollution will cost big money, but it is an essential investment.

Assuredly we all have the same goal — a safe and healthful environment in which everyone may enjoy the fruits of progress.

We can—we will—meet the challenge of air pollution.

*This article is based upon information gathered at Research-Cottrell, Inc.'s April 1959 seminar, the winter meeting of the MCA and the national conference called by the Surgeon General, November 1958.*

**H. E. Furgeson,** veterinarian, ranch manager, Anaconda Co., Anaconda, Montana

"I think we must recognize another attack to this problem [community planning]. I speak for my company—the Anaconda Co.—and I believe that when I speak for my company, I speak for my industry as a whole—and when we come into a town and decide to build a new plant, we make a complete survey, of the town, of the plant area where we propose to build, of population trends, of the meteorology and topography of the area. This we do on our own. Our company has had an air-pollution control department since 1930. We have been very active in the field. I think that our city planners should be cognizant of the time, dollars and effort that industry spends in city planning."

Gradually coal was replaced in part by oil for home heating and the oil in turn, and in part, by natural gas. It seemed for a time to reduce the dirt and grime. St. Louis and Pittsburgh invoked and enforced clean-up campaigns. In cities where there was social pressure, the dirt and soot began to disappear. Where there was no demand for clean air, the smoke and soot ruined all, as in Perth Amboy, N. J., "where no one seemed to care."

Since World War II, there has been a significant rise in pollution levels of the major cities of the world. Unfortunately, the only pollutant long measured is settleable solids. Since the start of these measurements some 25 years ago, the amount of settleable solids has been decreased tremendously. But times have changed and so has technology. When the survey began, the economy was largely based on coal. Today it is coal, oil, and gas, and tomorrow we will add uranium with all its potential hazards.

Dust collectors are more universally applied and more efficient. Dense clouds of smoke, once used by aviators as guides as far as 300 miles, are uncommon today. Yet, according to observers, our cities are getting dirtier. The dirt is still there, only finer, smaller and invisible to the eye—and, when coupled with toxic materials, it has led to pollution disasters.

There are regional patterns in air pollution levels. Coastal areas have higher high's and higher low's than do those inland. Desert air is the cleanest. Mountain and forest air is twice as dirty as desert; and farmland, such as that around the Great Lakes, is three times as dirty. Urban areas are five times as dirty as rural.

Since most of the sampling stations in the National Air Sampling Network are in California (100 out of 158), observers at the conference pointed out that neither sufficient knowledge of pollutants, their source, nor their methods of analysis are available. Many methods are not specific enough; others are too expensive and time-consuming. Better, cheaper, more reliable methods and instruments are needed.

The conference recommended that the National Air Sampling Network be expanded and that more money be authorized by Congress (this has been done). In general, as one sub-group reported, "There was a general concensus that grossly inadequate information on health effects of air pollution was available upon which to base sound, non-discriminatory legislation . . ."

Further research and development to speed up control of high temperature combustion and metallurgical processes was another recommendation by the conference. Still another was to find an economic means of removing trace amounts of sulphur and nitrogen oxides from combustion gases.

## A Lot To Be Learned

$H_2SO_4$ has been labelled as a cause of death in green plants, animals and man. Metallic fume and dust—manganese, lead, arsenic, vanadium, mercury and beryllium and their compounds—while invisible to the eye, have raised serious questions among toxicologists as to the probable physiological effects of chronic, low-level, long-term exposure. Sufficient information on chlorine, hydrogen fluoride, sulphur dioxide, ozone and some other gases as to their effect on vegetation has been collected so that emission limits could be set. There are numerous cases of damage to livestock by emissions of fluoride, lead and arsenic so that standards could be established for them as well; but for most of the thousands of other pollutants, no such data is available.

Fluorides and phosphorus compounds have aroused medical interest and in one case resulted in a court award to a plaintiff alleging impairment of personal health as a result of exposure to fluoride identified with a particular process.

Our modern industrial complex, consuming huge quantities of raw materials in the smelting, metallurgical, chemical, petroleum and power-generating fields, contributes an estimated 50- to 100-million tons of dust, smoke, fume and acids to the atmosphere every year. Control of those emissions by effective gas cleaning equipment is essential to prevent heavy, sometimes fatal air pollution.

In many instances, gas cleaners recover valuable by-products or return lost material to the process. In other cases, the equipment is installed and operated by industry at a loss, adding to the production cost, serving only to keep the neighborhood clean. It has been estimated by Research-Cottrell, Inc. that there are some 3,000 electrostatic precipitators installed in the U.S., collecting some 15-million tons of pollutants a year. In the coal-burning electric-power generating industry alone, the installed capacity of electrostatic precipitators is expected to climb from a present figure of 165 to over 300-million cfm by 1969.

Years ago, a dust collector or precipitator efficiency in the order of 90% was acceptable. Today's specifications are in the 95 to 99.5% bracket. If a collector offers a 90% efficiency on an installation releasing 100-tpd of dust, then 10 tons will escape through the collector. At 95% efficiency, the loss to the atmosphere will be cut to 5 tons. At 99%, the loss is one ton—one-tenth that of a 90% collector. But the cost of such high efficiencies can be very high.

Precipitator manufacturers have devices that collect at gas velocities of 7 ft per sec; they hope to double the figure in five years. Research-Cottrell reports 99.9% collection of 0.7$\mu$ dia oil mist at 25 fps. Others report collections as high as 90% efficiency at up to 100 fps velocities.

In conclusion, three needs were stressed by industry representatives at the national conference. One is the need for cheaper, more efficient control equipment. Industry is seeking this. Another is that a broader, more scientific fund of knowledge needs to be developed upon which to base sound air pollution control legislation. Research and industry are working to do this, for industry cannot long afford the high cost entailed in needless, drastic or hysterical regulations. The third and final need is for industry to tell its side of the story to the general public.

Those who travel in the mining industry know what is being done in Polk County, at Trail, Anaconda, Massena; what Kennecott is doing at Bingham or Bunker Hill at Kellogg to reduce the dust nuisance created by old tailing piles; what is being done today at Corpus Christi, Hayden, Baltimore and Ravenswood to prevent air pollution tomorrow. Unfortunately, except in the immediate locale, the general public does not.

**Table 1: Major Aluminum Deposits in Communist China**

| Approximate location | Ore reserves | Sample | Analysis (percent) $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | $TiO_2$ |
|---|---|---|---|---|---|---|
| Nanting vicinity (within 30 kilometer radius), Shantung Province, in area of coal mines and railway. | 100-million to 300-million metric tons (at least 30-million tons high grade) of diasporic bauxite (sometimes referred to as high alumina shale). | Best grade | 60 | 13 | 10 | 2 |
| | | Good grade | 53 | 20 | 9 | 2 |
| Penhsihu vicinity, Liaoning Province, in area of varied basic industries. | 50-million to 100-million metric tons (possibly 20-million tons high grade) of high alumina shale. | Mined grade | 53 | 20 | 10 | 3 |
| | | Low grade | 40 | | | |
| Kweiyang vicinity (including Kueichu and Shiuwen), Kweichow Province. | 200-million to 500-million metric tons (at least 50-million tons high grade) of diasporic bauxite. | Best grade | 70 | 9 | 1 | 2 |
| | | Good grade | 59 | 23 | 1 | 3 |
| | | Low grade | 38 | 40 | 1 | 3 |
| Sian vicinity, Shensi Province. | Unknown but undoubtedly extensive. Aluminous shale (presumably good grade). | No data | | | | |
| Kailan vicinity (various places in the Kaiping Basin), Hopei Province, in area of varied basic industries. | 100-million to 400-million metric tons (at least 30-million tons high grade) of bauxite clays and high alumina shales. | Laoshihshan | 50–65 | 5–20 | 9–15 | 1–3 |
| | | Kailan | 50–70 | 12–27 | 1–2 | 2–3 |
| | | Chaokehchuang best | 67 | 11 | 3 | 2 |
| Kunming vicinity, Yunnan Province. | 100-million to 150-million metric tons (at least 20-million tons high grade) of diaspore and boehmite. | Anning average | 52 | 33 | 3 | |
| | | Kunming best | 63 | 21 | 4 | |
| | | Fumin best | 70 | 6 | 11 | |
| Yangchuan vicinity, Shansi Province. | Unknown but moderately extensive. High alumina shale. | Typical | 45–55 | | | |

Note: Aluminum deposits generally cover wide areas and ores are of uneven grade. Data on reserves and analyses are intended only to show a general order of magnitude.

# Vast Expansion of Aluminum-Alumina Is Planned by Chinese Communists

**K. P. WANG**

COMMUNIST CHINA has a small integrated aluminum industry, which is in the process of rapid expansion. In 1958, the country probably produced about 27,000 metric tons of primary ingot. As of early 1959, the annual capacity for aluminum extraction is estimated at 60,000 metric tons and there is adequate alumina capacity to meet reduction needs. By 1960, the country probably will be producing close to the 1959 capacities. The goal for 1962 has been variously reported at between 100,000 and 120,000 tons of aluminum, an objective that most likely will be achieved in that or the following year. Aluminum output may well rise to 180,000 tons or more by 1965. Thus, Communist China is about to become a medium producer of aluminum by world standards. In 1959, its output most likely will exceed that of the United Kingdom.

The Communist Chinese aluminum industry has changed radically in the last few years. Operations were resumed on a small scale in 1954, after nearly 10 years of inactivity. By 1955, output of primary aluminum had exceeded the peak level during the Japanese occupation period (8,557 metric tons in 1943). Rehabilitation of alumina facilities was completed faster than those of aluminum so that there was a surplus of alumina in 1956 that had to be sent to the USSR for reduction. In 1957, ingot production reached the designed plant capacity of about 20,000 metric tons. During the period 1954-57, Chinese primary aluminum operations were almost entirely oriented around the rebuilding of two plants—the Fushun aluminum-alumina plant in Manchuria and the Nanting or Changtien plant in Shantung Province—which were initially established by the Japanese respectively in 1938 and 1944. In 1958 new capacity was added to those two plants, a small aluminum plant was completed in Peiping, and a number of large and small plants were initiated or planned in various parts of the country The future operating level of the Chinese aluminum industry will be determined primarily by the speed with which new plants are brought into production.

Developments in the industry are not confined to alumina and reduction facilities. There is evidence that fabricating facilities are also being expanded. Trade data imply such a trend. In 1955, roughly two-thirds of the aluminum ingots produced were sent abroad for processing; in 1956, less than a half; in 1957, no ingot was exported; and in 1958, very substantial tonnages were imported. The changes in the export-import pattern not only suggest rising demands but also a rolling capacity in Communist China more than adequate to handle domestic ingot output. The country reportedly purchased a substantial capacity of rolling equipment in 1958, and apparently some rolling equipment is made domestically. More than a dozen small aluminum rolling mills with capacities up to 5,000 tons per year are probably in existence, quite a few in the Shanghai area. An aluminum alloy plant in Harbin, Manchuria has been in full scale operation since 1956.

Aluminum is in great demand in Communist China. The Communists

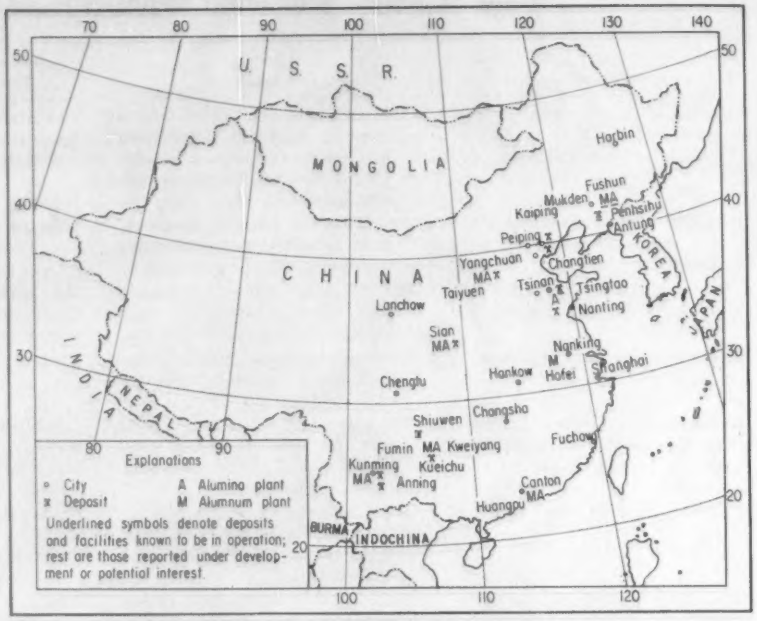
Mr. Wang is Far East Specialist, Division of Foreign Activities of the U.S. Bureau of Mines. The author notes that recent data included in the article are primarily based on unconfirmed Chinese reports.

estimate that 250,000 to 300,000 metric tons of aluminum would be required in the country's economy for every 10-million tons of steel. Annual steel output has already topped the latter figure, which implies that much more aluminum than what is produced can be used. In fact, as mentioned, large quantities of aluminum were imported in 1958. Civilian consumption, in the form of aluminum utensils and foil, is no longer important with the use of substitutes under the Communist program of regimentation. On the other hand, industrial consumption has greatly risen. The predominant portion of the metal is now used by the machinery and equipment, electric power, communications and, to a minor extent, the automotive and aircraft industries. The aluminum (including alloy) is generally made into castings, forgings, various rolled products, and extruded shapes. Making of wire and cables has become more significant, for the Communists recently have decided to use aluminum to substitute for 60% of the copper needed for power distribution and communications lines. The pattern of aluminum consumption in Communist China should gradually approach that of industrialized countries. Statistical data on production (see Table 2) and trade (see Table 3) for various aluminum products give a general idea of the past and future aluminum requirements for Communist China.

## Ores Are Difficult

Communist China has a strong aluminum raw material base to support its program of expanding metal production. More than 700,000 tons of aluminous materials were mined in the peak year, 1944, a fair proportion of which went to Japan. In 1958 probably about 200,000 tons were produced. Accurate reserve data are not available but estimated reserves run into more than half a billion tons of various grades of aluminous materials. Only a small part is adaptable to the conventional Bayer process, the bulk being diasporic bauxite, high-alumina shale, and alunite, which can only be processed by the soda-lime-sinter, calcium aluminate, the Soviet "semi-wet and dry" sulphuric acid, and other processes. Much of the ore is high in silica as well as relatively high in alumina. The Chinese Communists in recognizing that their aluminum industry must be built on non-Bayer ores, have investigated resources from the viewpoint of favorable geographical location to power and the feasibility of operations by methods other than the Bayer processes. As a result, many new extensive deposits have been uncovered. The best known and the most productive deposits are located near the Nanting alumina plant, Shantung Province, where more than a dozen mines exist. The next area of immediate significance is Penhsihu (not too far from Fushun), Liaoning Province. The Kweiyang deposits in Kweichow Province also have a bright future. Apparently, extensive reserves have been found near Sian, Shensi Province. These and other deposits are briefly described in Table 1.

The country has abundant resources of power as well as other materials needed for aluminum manufacture. Whereas raw materials for making alumina vary with the process, the power consumed in aluminum reduction is generally fixed. The Communists report that their operations require about 20,000 kilowatt hours of electricity per metric ton of aluminum in large plants and about 22,000 kwh in small plants. They also state that in order to produce 120,000 tons of aluminum in 1962, 440,000 kw of power capacity must be available. These concepts fall in line with Western techniques. Installing necessary power is not a serious future problem but the cost of power in Communist China appears to be a little higher than international standards. Non-aluminum raw materials, such as soda (from salt), fluorite, and electrode materials, are plentiful and relatively cheap. Generally speaking, power and raw materials will not hold back aluminum production in Communist China, especially if cost is not the basic consideration.*




Aluminum Deposits and Facilities in Communist China

| Symbol* | Name | Coordinates |
|---|---|---|
| M A | Fushun | 42° 17′N; 127° 19′E |
| X | Penhsihu | 41° 19′N; 123° 54′E |
| | Antung | 40° 08′N; 124° 24′E |
| A | Nanting | 36° 44′N; 118° 01′E |
| | Changtien | 36° 48′N; 118° 03′E |
| X | Mines near above | |
| | Kaiping | 39° 42′N; 118° 14′E |
| X | Deposits near above | |
| M A | Kweiyang | 26° 35′N; 106° 43′E |
| X | Kueichu | 26° 25′N; 106° 40′E |
| X | Shiuwen | 26° 49′N; 106° 37′E |
| M A X | Kunming | 25° 04′N; 102° 41′E |
| X | Anning | 24° 55′N; 102° 29′E |
| X | Fumin | 25° 14′N; 102° 29′E |
| M A X | Yangchuan | 37° 54′N; 113° 36′E |
| M | Hofei | 31° 51′N; 117° 17′E |
| M | Huangpu | 23° 05′N; 113° 25′E |
| M A X | Sian | 34° 16′N; 108° 54′E |
| | Harbin | 45° 45′N; 126° 39′E |
| | Shanghai | 31° 14′N; 121° 28′E |

* X Deposit A Alumina M Aluminum ° City

Bold faced symbols denote deposits and facilities known to be in operation; rest are those reported under development or of potential interest.

**Fushun plant**—Up to the present time this plant, located in an industrial complex of the same name, has been

*The Chinese Communists reported that the market price for aluminum at the end of 1958 was 3,000 Yuan (about $1,267) per metric ton or U.S. 57.4c per lb but that they were trying to bring the cost down to 1,500 Yuan.

**Table 2: Estimated Actual and Projected Production in Communist China, Selected Years**

(Metric tons)

| Year | Aluminum | Alumina |
|---|---|---|
| 1943* | 8,557 | 18,000 |
| 1953 | 0 | small |
| 1954 | 3,000 | 7,000 |
| 1955 | 10,000 | 24,000 |
| 1956 | 10,000 | 45,000 |
| 1957 | 20,000 | 50,000 |
| 1958 | 27,000 | 60,000 |
| 1959 | 40,000 | 100,000 |
| 1960 | 60,000 | 140,000 |
| 1961 | 80,000 | 190,000 |
| 1962 | 100,000 | 250,000 |
| 1965 | 180,000 | 450,000 |

*Maximum during the Japanese occupation period.

**Table 3: Approximate Trade Pattern in Aluminous Materials for Communist China, Selected Years**

(Metric tons)

| | Exports | | | Imports | |
|---|---|---|---|---|---|
| Year | Ore* | Alumina | Aluminum | Aluminum | Aluminum products |
| 1943 | 50,500 | 0 | 3,000* | small | small |
| 1944 | 147,400 | small | 4,200* | small | small |
| 1945 | 37,600 | small | 1,000* | small | small |
| 1955 | 13,500 | 0 | 7,000** | 100** | 2,800** |
| 1956 | 15,500 | 20,000** | 4,700** | 100** | 2,200** |
| 1957 | 37,200 | 0 | 0 | not available | 1,300** |
| 1958 | not available | not available | 0 | 37,000*** | not available |

*Imports by Japan from Communist China.

**Imports and exports by the USSR from and to Communist China.

***Unconfirmed. About half of total may have come from the USSR. France and Norway provided most of the rest; French and Norwegian data show that about 9,500 and 6,000 metric tons respectively were exported to Communist China.

producing virtually all of the country's aluminum. Its capacity is rated at 50,000 to 60,000 metric tons of ingot per year. Apparently, the Fushun aluminum plant has three sections, each with two batteries of 30-odd Soderberg cells. The first section was rebuilt from the Japanese plant, having started partial operations in 1954 and full scale operations in late 1956 (actually completed in 1955). The second and third sections are new; section two was completed in early 1958 and section three, at the end of 1958. Electricity in the form of hydropower and coal power is locally available, but because construction of power facilities lagged behind reduction facilities, section three of the Fushun aluminum plant lacked adequate power to operate in early 1959. This shortage appears to be temporary. The Communists contend that approximately 400 Yuan (or roughly $168) of electricity is needed per metric ton of aluminum.

When the Japanese operated the Fushun plant in the 1938-45 period, alumina was locally produced by treating high alumina shale from Penhsihu. During 1954-57 the bulk of the raw materials came in the form of alumina from the Nanting plant described below. It is surmised that the alumina plant at Fushun has, very recently, not only been rehabilitated but also greatly expanded. The calcium aluminate (electric fusion alumina) process and Penhsihu shale are probably still being used, whereby calcium aluminate and by-product ferrosilicon are recovered from electric smelting; the aluminate is ground, leached by a soda solution, and precipitated as aluminum trihydrate (by carbon dioxide) prior to calcining. This process is costly by Western concepts. The sulphuric acid process has been investigated, and a new alumina plant employing the method might eventually be built. The process involves treatment of pulverized aluminous shale with sulphuric acid to put aluminum and iron into solution before making a subsequent separation. Apparently, the Chinese Communists think that the sulphuric acid process is more superior than the calcium aluminate process.

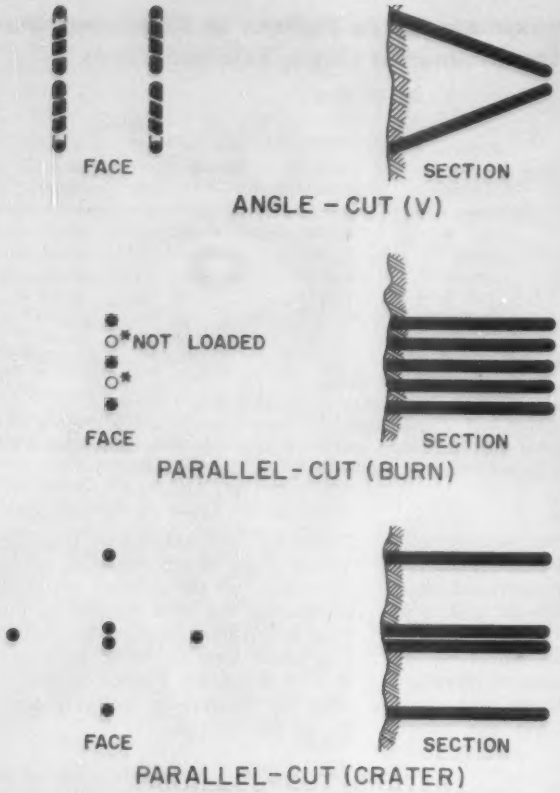
**Nanting plant**—This plant ranks second to Fushun in importance but produces only alumina. Nanting is located in an area of extensive deposits of diasporic bauxite (sometimes referred to as high alumina shale), coal, and limestone. The plant was first established by the Japanese near the end of World War II; little alumina was produced but large quantities of ore from the vicinity of the plant were extracted for shipment to Japan and former areas of the Japanese Empire. The Japanese used the soda-lime-sinter process, the Chinese Nationalists were thinking about a modified Bayer process in 1947, and now the Chinese Communists have adopted the Soviet "semi-wet and dry" process, whereby iron scrap is added to the ore for electric smelting to make crude alumina and ferrosilicon, the crude alumina being subsequently crushed and refined by a wet method. Nanting has had an annual capacity for alumina of more than 40,000 metric tons since the end of 1955 (the Japanese plant was reportedly 20,000 tons). The present capacity is presumably much larger, and further expansion is feasible because resources are available and more alumina is needed in the country. Since electric smelting is employed in making alumina, such a plant requires much more electricity than a Bayer plant. The power capacity in the Nanting area is probably in excess of 30,000 kw, and soda comes from the Yungli plant, Hopei Province. In recent years, all the alumina produced at Nanting has been shipped to Fushun for refining, except for 20,000 tons which went to the Soviet Union in 1956 when the Fushun aluminum plant was temporarily unable to process all the alumina.

**The largest aluminum** plant now being constructed apparently is a 100,000-ton per annum unit in Sian, Shensi Province. A related alumina plant, also under construction, is in nearby Weipei. No details on schedules and operating conditions are available. However, the area in which plants are located has extensive coal resources, and, most likely, substantial resources of aluminous shale.

A second integrated aluminum-alumina plant, said to be larger than Fushun (50,000 to 60,000 tons of annual aluminum capacity), is being built at Kweiyang, Kweichow Province, in an area of known extensive and high-grade aluminum ores. The latest information shows that the plant is scheduled for completion by 1962, and that partial operations may begin in late 1959.

A third plant located in Hofei, Anhwei Province (capacity not available) is believed to be on the order of 10,000 tons aluminum per year or slightly more, and is planned for completing in mid-1959. A fourth plant at Huangpu in the suburbs of Canton, with a minimum annual aluminum capacity of 10,000 tons, was scheduled to begin partial operations in early 1959. A fifth plant in Yangchuan, Shansi Province (capacity not available but believed to be fair-sized) has been under construction since mid-1958 and the first part of the plant has probably been completed.

(Continued on p. 123)




**TYPICAL CUTS** used in underground drifting can be classified as angle or parallel depending on hole orientation.

**RING CUT** is parallel type in which diameter can be made to fit ground conditions as determined by dynamic rock tests.

# Ring Cut Proves Promising Basis For Universal Drift Round

**GEORGE B. HUBER**

AN ULTIMATE GOAL of research on explosives and their underground effects is, of course, a means of predicting the best combination of blasthole size and orientation and explosive type, weight and distribution for any given rock and job. But with so many variables plus the further influence of the machinery, ventilation and other factors involved, such an objective is obviously difficult to achieve. However, a review of mining technique suggests that even a standard development round—economical and effective under a wide variety of conditions—would be very desirable in modern mining, especially if augmented by a cheap, readily-used test for rock that would indicate optimum hole size and spacing in any particular rock.

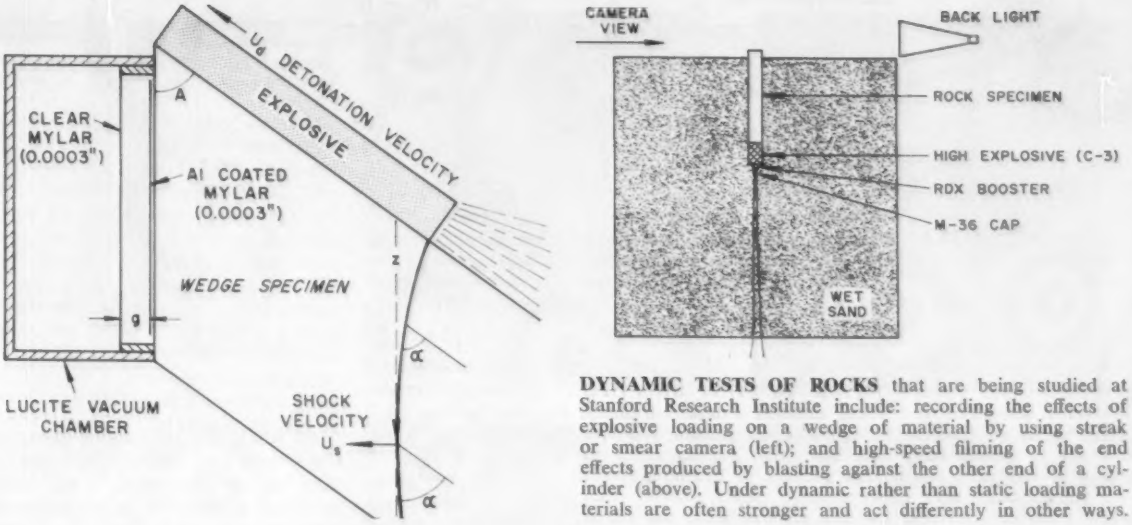
In recent years, new methods of research, both theoretical and experimental, have been developed to enhance our understanding of the blasting process. In the field of explosives such considerations as mechanisms of decomposition, detonation temperatures and pressures, etc., are better known. In addition, knowledge of how materials act when blasted has increased greatly, supplementing previous knowledge gained in the field of rock mechanics. Such basic research will help in solving more and more of the mining industry's many perplexing problems.

At Stanford, basic research is giving good results toward finding a universal-type drift round.

In non-nuclear underground blasting, the uses of explosives to break rock may be grouped into two broad categories: single surface blasting and multiple surface blasting. Multiple surface blasting includes any operation in which two or more faces have been made free by some previous operation. Falling into this category are most bulk extraction or "stoping" operations, as well as secondary blasting. Blasting to one surface is peculiar to those excavations proceeding into undisturbed material, such as shafts, tunnels and other development openings—most of which have relatively small cross-sectional area.

Nevertheless, the advancement of an opening into a solid medium actually involves procedures that are fundamental to all underground blasting. The majority of underground excavations are made by first drilling a number of holes into a rock surface in a predetermined pattern or "round". Next, relatively small explosive

Mr. Huber is mining engineer at Stanford Research Institute's Poulter Laboratories in Menlo Park, California.




**DYNAMIC TESTS OF ROCKS** that are being studied at Stanford Research Institute include: recording the effects of explosive loading on a wedge of material by using streak or smear camera (left); and high-speed filming of the end effects produced by blasting against the other end of a cylinder (above). Under dynamic rather than static loading materials are often stronger and act differently in other ways.

charges are placed into these holes; and then, by blasting each hole or a group of holes in sequence, the required breakage is achieved. However, in a development round, the location and size of the drillholes and the use of explosives in these holes are usually designed to produce an initial opening or "cut" in the original surface and thereby expose a new surface that is oriented for more effective utilization of the remainder of holes in the round.

## Cuts Are of Two Basic Types

Current practice employs two general schemes for making the cut—the angle cut (V or wedge, pyramid and draw) and the parallel cut (burn or shatter and crater or no-cut)—as well as various combinations[1,2].

In an angle cut the holes are drilled at convergent angles to the face of the opening in order to break a wedge or cone from the rock.

In parallel cuts the holes are drilled essentially perpendicular to the face and require holes that are close together and nearly parallel. In the shatter cut some holes are not charged, serving as "break-to" holes for the charged holes. The aim is to pulverize and eject a cylinder of rock. But it is interesting to note, if all the holes in a shatter cut are charged and blasted simultaneously, very often the same desired effect is produced. Such a cut resembles the crater cut that is gaining popularity, particularly through the work of Hino[3]. However, the crater cut is designed to accommodate the weight of explosives needed to make an essentially conical crater whose apex reaches the center of gravity of the charge. It is based on the surface spalling effect of blast waves.

The application, advantages and disadvantages of the various cuts are rather widely known, except for the crater cut. Briefly, the crater cut has met with considerable success in tunnels and headings of rather large cross-section—12x12 ft. But depth of advance that can be obtained using the crater cut alone is seriously hampered in openings of less than 9x7 ft because the sides of the crater are generally near 45 deg to the face. In a 7x9-ft drift, therefore, advance would be limited to 3 or 4 ft per round.

## Rock Type Affects Results

Perhaps the most influential factor governing the effect of explosives underground is the enormous variety of rock to be blasted. Each particular mining area has its own characteristic type of rock. Hence, a comparison of blasting methods between mines in different areas frequently has little meaning. The great variety of these rounds indicates that there is a need for a small number of basic flexible patterns that will produce consistent results in a wide range of rock types. Many empirical formulas for rock blasting from necessity include a number of different "rock constants" to embrace the entire field of rock blasting. These are determined by observation or from static measurements.

One of the newest approaches to the comparative study of rock types being done at Stanford Research Institute is to observe them under actual explosive impact. The advantages of observing these materials under conditions similar to blast hole conditions is obvious. The fact that materials behave differently under dynamic loads as compared to static loads is most easily shown in the case of metals. And recent evidence indicates that this is also true in rocks.

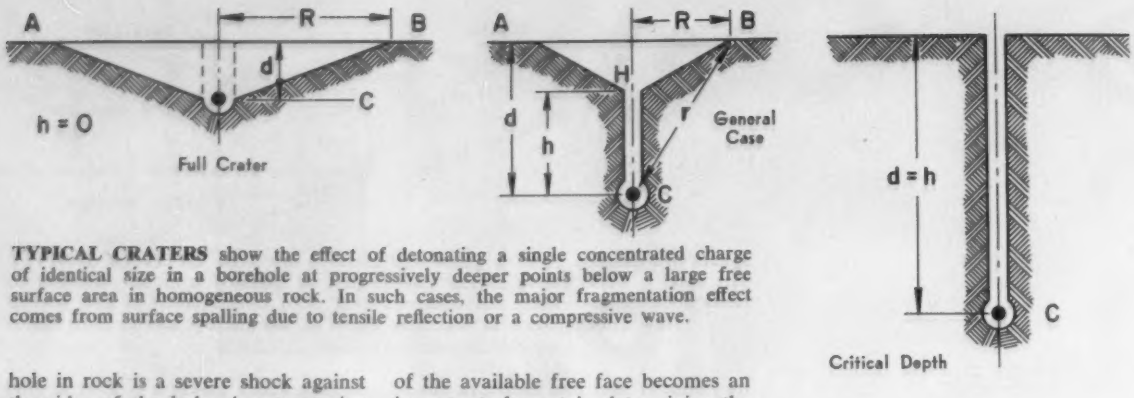
One technique used to analyze rock behavior under explosive loading is to observe the effects on a wedge of material (see drawing above, left). These observations are made with a smear or streak camera. Information derived from the wedge experiments include data on the shock velocity in the material and the free surface velocity of the wedge face. From this information particle velocity and pressure decay in the material can be estimated. Phase transitions, if any, can also be observed. The pressure limits available with this method range from 25 to 300 kilobars, depending on the thickness of explosive used and material under observation.

Other explosive techniques for studying rocks include shock loading one end of cylindrical specimens (30-50 mm dia x 50-300 mm long) with rather large amounts of explosive (50-150 gm C-3) (see drawing above, right). Velocities of the end of the specimen are observed and from these velocities the pressure that the material can support, as compared to static compressive tests, is determined. An examination of non-porous graywacke, for example, proved it to be over four times stronger under dynamic explosive loading than under static loading.

Tests of this nature are necessary for a true evaluation of explosive underground effects and for a realistic approach to the design of future blasting patterns.

## Basic Blast Effects Now Known

The first effect of detonating a cylindrical column of explosive in a bore




**TYPICAL CRATERS** show the effect of detonating a single concentrated charge of identical size in a borehole at progressively deeper points below a large free surface area in homogeneous rock. In such cases, the major fragmentation effect comes from surface spalling due to tensile reflection or a compressive wave.

hole in rock is a severe shock against the sides of the hole. A compressive wave is produced and if the strength of the compressive wave exceeds the dynamic compressive strength of the rock, crushing occurs. When, due to energy transfer and wave front expansion, the compressive wave strength has attenuated to the point where crushing ceases, the wave proceeds essentially as an elastic wave. Any interface that is in the path of the compressive wave causes a reflection of the wave back into the first medium. At a free rock surface the reflection is tensile and if the strength of this reflected tensile wave exceeds the dynamic tensile strength of the rock, spalling occurs. Although these are considered the basic fragmenting effects of blasting, there are others[4].

The results obtained when a strong tensile shock is reflected from a free rock surface to form a crater has been described by Livingston,[5] Poncelet[6] and others. Three typical craters described by Livingston (see drawings above) are the results of placing identical, single concentrated charges at increasingly deeper positions in rock below a large free surface area. As the charge is placed deeper in the material, less energy is available for spalling or fragmentation at the surface because of absorption by the intervening material and dissipation over a larger wave front. At first, a complete crater is formed to the depth of the explosive. Next, the cratering does not extend to the former position, and finally, there is insufficient energy available from the explosive charge to form a crater.

However, it is pertinent to point out here, that blasting boreholes in relatively small development headings is unique in comparison to most surface mining, stoping and other blasting techniques. Small underground shots, initiated from the bottom of the holes, are essentially in a semi-infinite, semi-homogeneous mass with only the small cross-section of the working face available to reflect waves in tension. And in considering effects due to reflected tensile waves from underground explosions, the size of the available free face becomes an important element in determining the depth of craters that can be formed.

When two parallel boreholes drilled a foot apart in a solid rock face of small area, are blasted simultaneously, they produce a characteristic crater similar in shape to a crater formed by the one-hole shot previously mentioned. The crater depth is still limited by the dimensions of the opening or free face. But when the holes extend beyond the limiting depth of cratering there is another effect—the region where the two expanding compressive wave fronts meet is generally well broken due to the sharp increase in pressure.

Loading three parallel holes in a rock face one foot from each other produces effects which are very similar to the result from two holes. If, as in the preceding case, the holes extend beyond the limiting point of cratering for a particular weight of explosive, then there is a zone of intense pressure build-up at the point where the three compressive waves converge. In many cases, the rock from this high pressure zone is still in place in the rock face. But, depending on the explosive load, it may be blown into the drift. That strong compressive waves meeting each other form a highly stressed region has been demonstrated before with metals and plastics.

## Ring Cuts Work Well

To determine the effects of blasting still more holes at the same time, a number of square and hexagonal test patterns were drilled and fired.[7] A typical pattern of holes in the test series consisted of six holes, five feet deep, drilled at an 11-in. radius from a center hole (top left photo, next page). The holes were charged with primers at the bottom. Charges in the six outer holes were detonated simultaneously and the charge in the center hole was detonated 50 milliseconds later.

The center hole may serve several purposes. For one thing, it provides a free, though relatively small, surface from which the converging compressive waves can reflect. Furthermore, since the hole is loaded, it may assist in cleaning material from the cut—whether it is sympathetically detonated by the pressure build-up from the converging waves or whether the charge goes off as scheduled, 50 milliseconds later.

The results of such a cut blast was a crater at the drift face (top right photo, next page). It was essentially in the shape of a truncated cone. The cone diameter was six feet at the original face and two feet in diameter at a point 18 in. from the original face. From that point on, the cavity made by the removed rock was hexagonal in shape with the six points conforming to the six original holes. The ring holes pulled essentially to the bottom with an average of 3-in. "bootleg" on 3 holes. The muck pile started about 25 ft from the face and the sizing was excellent, consisting of material below 8 in. in size.

The most interesting facts noted in this and similar shots were the size of the opening that can be obtained beyond the depth of crater formation and the lack of excessive throw that sometimes results from millisecond blasting in underground headings. The openings created by firing the first six holes, considering cross-section and length, are characteristically much larger than openings created by other types of cuts. The throw of a blast using this configuration can be controlled by the amount of explosive used and a slight downward angling (5 to 10 deg) of the holes.

Using this method for the initial cut of a complete six-ft round gave excellent results (see last two photos). Maximum throw occurred 55 ft from the new face. Only 10% of the broken rock lay between 25 and 55 ft from the face and the remaining 90% was within 25 ft.

Because the cut holes used in a round like this are placed roughly in a circle about the middle hole, it is very easy to compensate for different

**LARGE CRATER** (far right) results from blasting bottom-primed ring-cut (right) in granite using simultaneous detonation of ring, 50 ms delay of center.

types of rock. By enlarging or reducing the ring of holes, any number of rock conditions can be met, while the basic pattern remains the same. Dynamic studies of rock properties are being conducted in an effort to relate them to various aspects of this basic design and thereby make it the sought-after universal round. Furthermore, the large initial opening may enable the use of another procedure: the use of a high-strength, high-velocity explosive to break the initial cut and a low-cost, heaving explosive to stope the rest of the holes to the opening.

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3. Hino, K. "Concentrated Type of No-Cut Round of Blasting," **Journal of the Industrial Explosives Society, Japan**, Vol. 16, No. 3, 1955.
4. Livingston, C. W., "Theory of Fragmentation in Blasting," **Sixth Annual Drilling and Blasting Symposium**, University of Minnesota, 1956.
5. Livingston, C. W., "An Introduction to the Design of Underground Openings for Defense," **Colorado School of Mines Quarterly**, Vol. 46, No. 1, 1951.
6. Poncelet, E. F., et al., "Fundamental Studies of Small Cratering Charges," **SRI Final Report, Project GU-1119**, Vol. 2, Part A, February 15, 1956.
7. Huber, G. B., "No-Cut Drift Rounds," **Thesis Report**, Montana School of Mines, January 1957.


### Editor's Note:

Large diameter break-to holes in burn cuts have recently proven useful for longer drift rounds. Such longer rounds permit longer cycles with fewer non-productive periods. Many of the cuts developed are also based on a circular pattern of holes[1].

Detailed reviews on the mechanics of blasting have been presented at various symposia over the past several years[1-6] and are well worth reading. A comprehensive text on explosives and their effects is also available.


1. Bullock, R. L., "Fundamental Research on Burn Cut Drift Rounds," Symposium on Mining Research, **Bulletin of the University of Missouri School of Mines & Metallurgy**, Tech. Series, No. 95, 1958.
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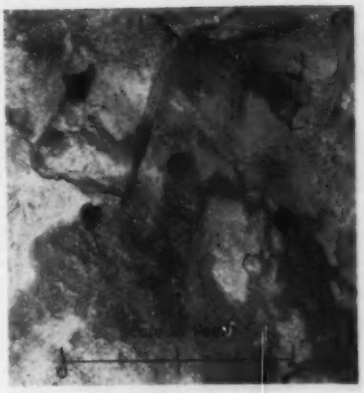
3. Rinehart, J. S., "Fracturing Under Impulsive Loading," same as 1. above, based on Rinehart, J. S., and Pearson, J., **Behavior of Metals Under Impulsive Loads**, American Society for Metals, 1954.
4. Ruff, A. W., "Seismic-Wave Measurements in Underground Blasting," **Eighth Annual Drilling and Blasting Symposium**, University of Minnesota, 1958.
5. Huber, G. B., "Explosives Research at Stanford Research Institute," as in 4. above.
6. Duvall, W. I., and Atchison, T. C., **Rock Breakage By Explosives**, Report of Investigations 5356, U.S. Bureau of Mines, September 1957.
7. Cook, M. A., **The Science of High Explosives**, ACS Monograph No. 139, Reinhold Publishing Corp., 1958.

**COMPLETE ROUND** with six-hole ring (above right) was drilled six feet deep and produced compact pile of well-broken muck fairly close to the face (right)

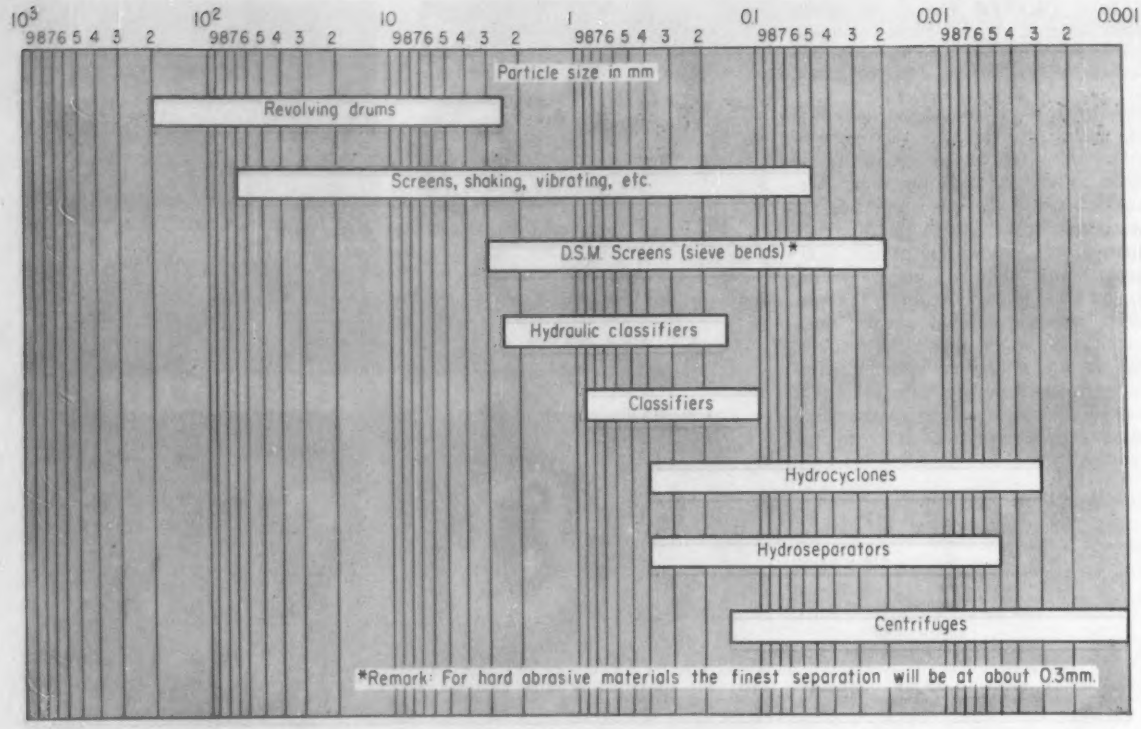

10³ 10² 10 1 0.1 0.01 0.001
9 8 7 6 5 4 3 2
Particle size in mm
Revolving drums
Screens, shaking, vibrating, etc.
D.S.M. Screens (sieve bends)*
Hydraulic classifiers
Classifiers
Hydrocyclones
Hydroseparators
Centrifuges
*Remark: For hard abrasive materials the finest separation will be at about 0.3mm.

**FIG. NO. 1.** The various devices that operate on the basis of a difference in velocity of particles in uniform motion in a medium are graphically illustrated above. The specific gravity of the particles in this case is assumed to be 2.7.

# A Guide to Solid-Liquid Separations

**F. J. FONTEIN**

FOR SEPARATIONS according to size, shape or specific gravity in a wet medium, an enormous variety of apparatus is available. However, the number of separating methods showing fundamental differences and hence producing fundamentally different separations, is not very great.

If one is faced with a problem of separating solid particles, it is important to have a survey of the fundamentals and characteristics of these possible methods and of the principal devices available.

The separating principles of the cyclone and the DSM sieve bend screen will be dealt with in somewhat greater detail. Particular stress will be laid on the less well-known possibilities of these devices.

In principle, separations are possible—based on the differences in velocity in a medium (classification and cycloning); based on the fact that a particle can only pass through holes larger than itself (screening); based on the fact that a particle enveloped by a flowing medium which is divided into two currents, is entrained by that current in which it is contained wholly or for the greater part (DSM sieve bend screen).

## Based on Differences in Velocity

Many methods are based on this principle, which can be used for making separations according to particle size, shape and also for separations according to specific gravity.

The following sub-division may be made:

Using the differences in velocity in the case of substantially uniform motion.

Using the differences in velocity in the case of accelerated or retarded motion.

In the former, the size of the particles greatly influences the velocity—this method can therefore be applied when separation according to size is required.

A separation according to the specific gravity of various-sized particles can only be made with the aid of this method, if the specific gravity of the medium lies between the specific gravities of the particles to be separated, so that lighter particles move in a direction opposite to that of the heavier ones.

In the latter, the specific gravity is generally an important factor, for which reason this method is often used for specific gravity separations.

These points will be explained in greater detail later on.

### Uniform Motion in a Medium

Uniform motion in a medium is the state in which a particle, under the influence of the gravitational or the centrifugal force, moves or falls at a constant rate with respect to the medium.

In this case, the gravitational or the centrifugal force acting on the particle, minus the force resulting from the law of Archimedes working in the opposite direction, is in equilibrium with the resistance that the particle, experiences as a result of its motion.

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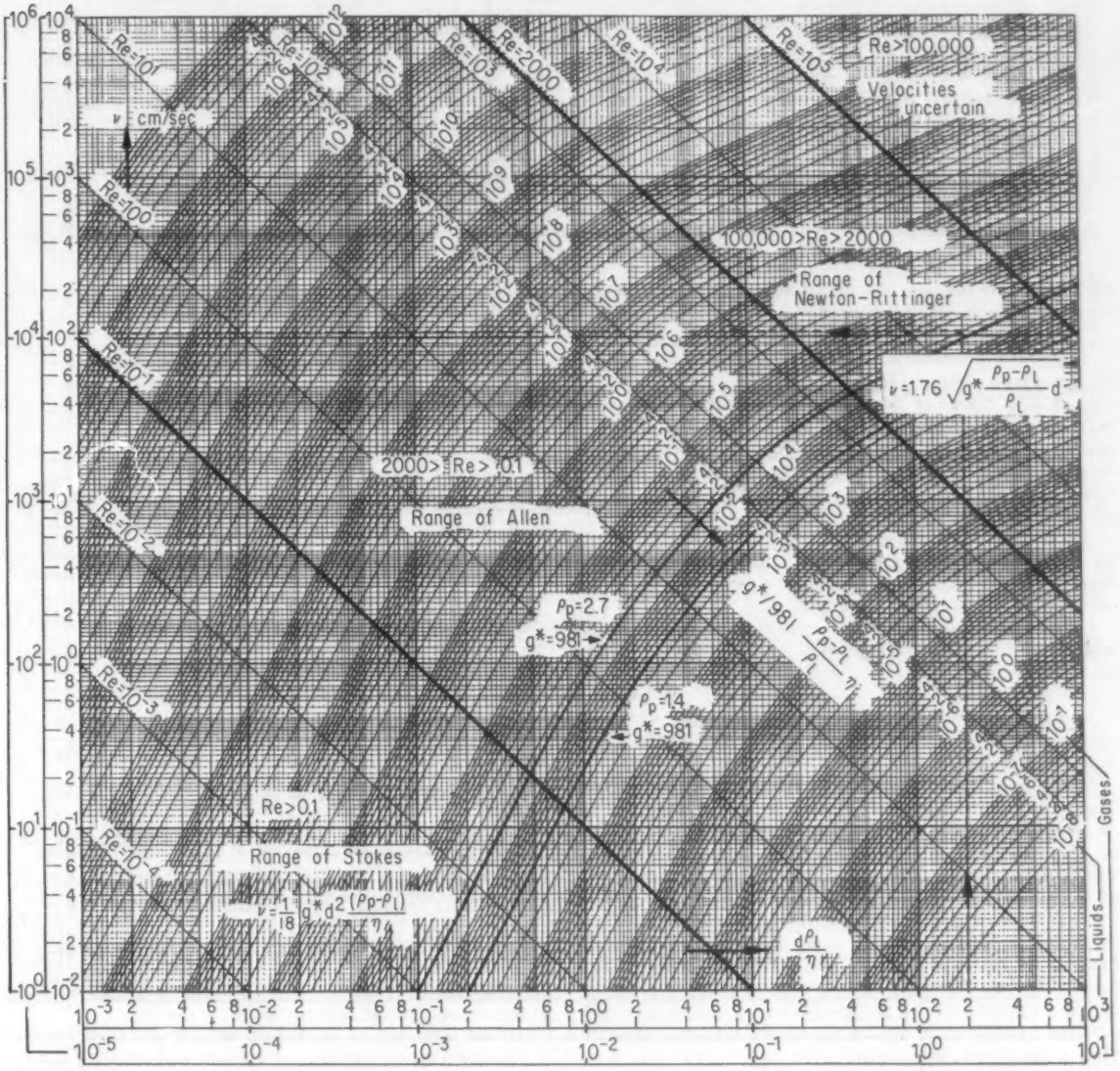
## FIG. No.2–VELOCITIES OF FALL OF SPHERICAL PARTICLES IN LIQUIDS AND GASES

Example: Required is the velocity of fall $v$ in water of 20°C of a ball with a diameter d=2cm. Density of water $\rho_l$=1 g/cm$^3$. Abs. visc. of water $\eta$=.01 poise. Density of sphere $\rho_p$=3 g/cm$^3$

We calculate $\frac{d\,\rho_l}{\eta}$=200 and $\frac{\rho_p-\rho_l}{\rho_l^2}\eta=2\times10^{-2}$ From the value 200 on the abscissa we follow the arrow as far as the intersection with the curve for which $\frac{\rho_p-\rho_l}{\rho_l^2}\eta=2\times10^{-2}$ and we find $v$=102 cm/sec.

The scale for liquids must be used.




$v = 1.76\sqrt{g^*\frac{\rho_p-\rho_l}{\rho_l}d}$

$v=\frac{1}{18}g^*d^2\frac{(\rho_p-\rho_l)}{\eta}$

$\frac{g^*}{981}\frac{\rho_p-\rho_l}{\rho_l}\frac{}{\eta}$

$\frac{d\rho_l}{\eta}$

$v$ = Velocity of fall in cm/sec

$d$ = Diameter of sphere in cm

$\rho_p$ = Density of sphere in g/cm$^3$

$\rho_l$ = Density of the liquid or gas in g/cm$^3$

$\eta$ = Viscosity of liquid or gas in poise

Re = Reynolds number = $\frac{v\,d\,\rho_l}{\eta}$

$g^*$ = Acceleration in the field in cm/sec$^2$

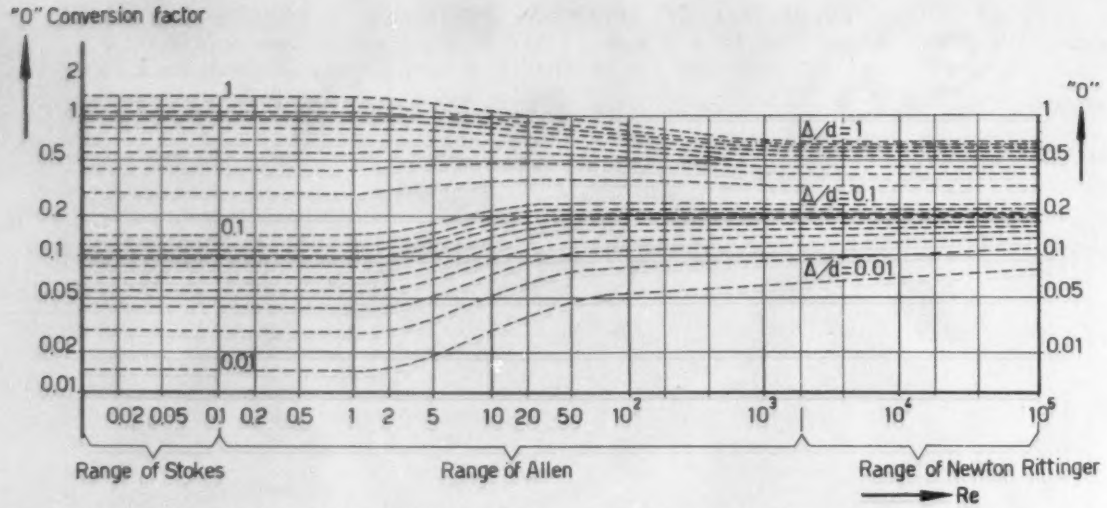



**FIG. NO. 3.** It has been found that in many cases this sketch may also be used for determining the rate of fall of particles of any other shape. In this case $d$ is the screening size of the particle and $\Delta$ is the smallest dimension of the particle.

The uniform velocity of spherical particles can be determined by means of Fig. No. 2. This figure further shows that at low values of the Reynolds' number, Stokes' law holds good—the velocity of fall being proportional to the square of the particle diameter. At high values of the Reynolds' number, the process is governed by the Newton-Rittinger's law according to which the velocity of fall is proportional to the root of the particle diameter.

From the foregoing it follows that in the range governed by Stokes' law, the particle size has a much greater influence on the velocity of a particle than in the range in which Newton-Rittinger's law is obeyed.

Consequently, a separation according to particle size will be more easily accomplished in the range in which Stokes' law holds than in the range governed by the Newton-Rittinger's law.

Making use of Fig. No. 2 and Fig. No. 3 combined, one can determine the rate of fall of disk-shaped particles with different $\Delta/d$ values.

It has been found that in many cases Fig. No. 3 may also be used for determining the rate of fall of particles of any other shape. In this case $d$ is the screening size of the particle (the diameter of the aperture through which it can just pass) and $\Delta$ is the smallest dimension of the particle.

With the aid of the falling velocity formulae according to Stokes and according to Newton-Rittinger and with the help of Fig. No. 3, the data of Table No. 1 have been calculated. From Table No. 1, it follows that a separation on the basis of uniform motion between flat and spherical particles can be better effected at high Reynolds' numbers than at low Reynolds' numbers.

## Motion in a Medium

Though the particle size is of great importance with uniform falling velocity under the influence of gravity or centrifugal force, this size has little effect on the velocity at the start of an accelerated motion. At the very start of a motion, when the velocity of a particle is raised from zero to a very low value, the resistance offered to the particle by the medium is negligible. The velocity of the particle at this stage can be calculated by means of the formula.

$$v = at \quad \text{.....Eq. 1}$$

## Table No. 1—Separations Based on Velocity

| Diameter disk ÷ Diameter sphere | 1.6 | 6.2 | 2.5 | 18 | 7.7 | 160 |
|---|---|---|---|---|---|---|
| When disk and sphere have equal falling rates. | Stokes range (Re<1) | Range of Newton-Rittinger (Re> 2000) | Stokes range (Re<1) | Range of Newton-Rittinger (Re> 2000) | Stokes range (Re<1) | Range of Newton-Rittinger (Re> 2000) |
| | $\Delta/d$ | =0.3 | $\Delta/d$ | =0.1 | $\Delta/d$ | =0.01 |

where:

$$a = \frac{K}{m_p + m_{al}} = \frac{g^* (\rho_p - \rho_l)\, V}{V\rho_p + A\, V\rho_l} = \frac{g^* (\rho_p - \rho_l)}{\rho_p + A\rho_l} \quad \text{.....Eq. 2}$$

substitution of Eq. 2 in 1 gives:

$$v = g^* \frac{\rho_p - \rho_l}{\rho_p + A\rho_l} t \quad \text{.....Eq. 3}$$

substitution of Eq. 2 in the formula $S = \frac{1}{2}$ at $t^2$ leads to the following formula for the path covered:

$$S = \frac{1}{2} \frac{\rho_p - \rho_l}{\rho_p + A\rho_l} t^2 g^* \quad \text{.....Eq. 4}$$

It may be remarked that in Eq. 3 and 4, no symbol representing the particle size occurs.

For an ellipsoid of revolution having an axial length in the direction of motion $= 2c$ and a diameter $= 2b$, the ratio $A$—i.e. volume of entrained liquid/volume of the ellipsoid—as a function of $c/b$, can be calculated[1].

Table No. 2 gives the value of $A$ for various values of $c/b$. This table has been taken from literature reference [1].

By means of Eq. 4 and Table No. 1 we shall, by way of illustration, calculate the distance covered at the start of an accelerated motion by a spherical particle having a specific gravity of 1.4 as compared with the distance covered by a spherical particle with a specific gravity 2.7.

For the 1.4 particle we find:

$$S = \frac{1}{2} \frac{1.4 - 1}{1.4 + \frac{1}{2}} t^2 g^* = 0.105\, g^* t^2 \quad \text{.....Eq. 5}$$

## Table No. 2—Values of A for Various Values of c/b

| c/b | A | 1.0 | 0.500 |
|---|---|---|---|
| 0.0 | ∞ | 1.2 | 0.401 |
| 0.2 | 3.008 | 1.5 | 0.304 |
| 0.4 | 1.428 | 2.0 | 0.201 |
| 0.6 | 0.908 | 5.0 | 0.059 |
| 0.8 | 0.651 | ∞ | 0.000 |

For the 2.7 particle:

$$S = \frac{\frac{1}{2}\,2.7 - 1}{2.7 + \frac{1}{2}}\, t^2\, g^* = 0.266\, g^*\, t^2 \quad \text{.....Eq. 6}$$

Consequently, for very short times $t$ the following quotient holds good:

$$\frac{\text{distance covered by a 1.4 sphere in water}}{\text{distance covered by a 2.7 sphere in water}} = \frac{0.105}{0.266} = 0.395 \quad \text{Eq. 7}$$

Using Eq. 4 and Table 1, we shall now calculate the value of the quotient:

$$\frac{\text{distance covered by 1.4 sphere in water}}{\text{distance covered by 1.4 ellipsoid } c/b = 0.2 \text{ in water, axis of length } c \text{ // direction of motion}}$$

The following formula holds for the ellipsoid:

$$S = \frac{\frac{1}{2}(1.4 - 1)}{1.4 + 3.008}\, t^2\, g^* = 0.0453\, g^*\, t^2 \quad \text{.....Eq. 8}$$

From (8) and (5) it follows that:

$$\frac{\text{distance covered by 1.4 sphere in water}}{\text{distance covered by 1.4 ellipsoid, } c/b = 0.2, \text{ axis of length } c \text{// direction ol motion, in water}} = \frac{0.105}{0.0453} = 2.32 \text{ . Eq. 9}$$

For an ellipsoid of 2.7 specific gravity, $c/b = 0.2$, axis of length $c$ direction of motion in water holds, that:

$$S = \frac{\frac{1}{2}(2.7 - 1)}{2.7 + 3.008}\, t^2\, g^* = 0.148\, g^*\, t^2 \quad \text{.....Eq. 10}$$

From (10) and (6) it follows that:

$$\frac{\text{distance covered by 2.7 sphere in water}}{\text{distance covered by 2.7 ellipsoid, } c/b = 0.2, \text{ axis of length } c \text{ // direction of motion, in water}} = \frac{0.266}{0.148} = 1.8 \text{ . Eq. 11}$$

From the foregoing, it is concluded that at the start of an accelerated motion a separation according to specific gravity, independent of the particle size, is effected. Further, it follows that a separation according to the degree of flatness, independent of the particle size, is made —effected more easily when the specific gravity of the particles of different flatness differs less from the medium.

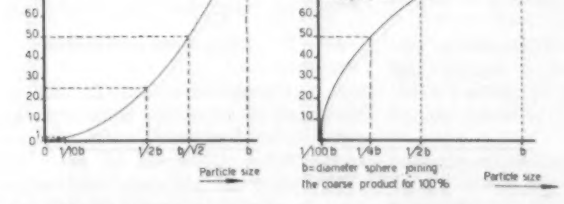



**FIG. NO. 3 AND 4** show clearly that the separation in the Newton range is very unsharp in normal classifiers.

It should be added that for screening flattish particles, a slotted DSM sieve bend screen is comparable with a slotted vibrating screen, and a DSM screen with holes is comparable to a vibrating screen with a screen surface of punched plate or screen cloth.

The classifiers belong under this heading—the hydraulic classifiers, the hydroseparators, the centrifuges, the heavy medium washers and, for some applications, cyclones.

Classifiers and hydroseparators are actually tanks into which a mixture of particles and liquid is fed. The slowly settling or floating particles flow together with the liquid across the overflow weir of the tank and the rapidly settling particles are removed from the bottom part of the tank in some way.

In the so-called hydraulic classifiers, an upward flow of liquid is maintained. Particles having a high rate of fall settle against the current and are removed at the bottom of the classifier. It will be clear that this method creates the possibility of obtaining a "rapidly settling" product which in essence contains no slowly settling particles, whereas in the normal classifier, slowly settling particles get a chance of joining the settling product.

In the case of normal classifiers and classification curves (see Neumark[2] and Fontein[11]) for spherical particles of one specific gravity in the Stokes and Newton ranges can be calculated for a formalized case. Fig. No. 4 and 5 show these curves.

These figures clearly show the separation in the Newton range to be very unsharp. Therefore, normal classifiers are seldom used for coarse separations where the particles in settling obey Newton's law. When a normal classifier is used for coarse separations, a high viscosity is usually chosen in order that the separation may be made in the range where Stokes' law holds. This high viscosity can, for instance, be obtained by making the classification at a high solids concentration.

In principle, centrifuges may also be classified into devices in which the rapidly settling fraction travels against a current of liquid and others where this is not the case.

In most cases, with normal classifiers, the feed does not contain any particles having a lower specific gravity than the medium. Therefore, a separation according to specific gravity is seldom obtained with these devices. Hydraulic classifiers operating with hindered settling are an exception to the rule. In these devices, particles of high specific gravity often form a so-called "teeter bed", a suspension of particles of high specific gravity through which the water flows upwards.

*(To be continued)*

## Symbols Used in the Equations

$S$=path covered by the particle in the medium
$v$=velocity of particle
$t$=time in which the path $S$ is covered
$K$=force causing the acceleration $a$
$a$=acceleration
$m_P$=mass of the accelerated particle
$m+i$=mass of the liquid or medium entrained by the particle
$2c$=length of ellipsoid axis // direction of travel
$2b$=diameter of ellipsoid ⊥ direction of travel
$d$=diameter of sphere, particle size
$\rho_P$=density of particle
$\rho_l$=density of liquid or medium
$C_1$=constant
$C_2$=constant
$\Delta$=thickness of a particle, thickness of a disk shaped particle
$V$=volume of particle
$\mu$=viscosity of medium
$g^*$=acceleration as a result of gravity or centrifugal force in the field considered

$$O = \text{conversion factor} = \frac{\text{velocity disk with diameter } d}{\text{velocity sphere with diameter } d}$$

$$A = \frac{\text{volume of liquid entrained by particle}}{\text{volume of particle}}$$

# Janol Method— A New Mining Concept

**INGVAR JANELID**
**GUNNAR OLSSON**

IN ROCK BLASTING employing shotholes, it is desirable to place the hole parallel to the face to obtain maximum effect of the explosive. This manner of placing the holes is used in benching and stoping; in short wherever two free rock faces are presented to the miner.

However, in regular drifting, tunneling and shaft sinking, there is only one face in the direction of the advance, and to obtain a second one it is necessary to use some type of cut. Toward the second face, created by the cut, the remainder of the rock is shot out.

To break out the cut often requires 10 to 15 times more drilled footage and explosive per unit of broken rock than for the remainder of the round, which of course affects the output, particularly in small drifts

## Principle of Janol Method

In the newly developed Janol method, blasting is accomplished by means of shotholes placed parallel to the face intended to be broken out, i.e. at about right angles to the line of advance. Holes placed in this manner produce the best blasting effect.

A prerequisite for placing the holes parallel to the face in a drift or room is that the holes can be drilled from an adjacent gallery running alongside the new drift or room, as shown in Fig. 1. When driving a number of parallel drifts according to the Janol method it is necessary to advance one drift by some conventional method to obtain a drilling gallery for the adjacent drift. The latter will then serve as a drilling gallery for the third one, and so on.

Referring to Fig. 1 it is apparent that the new drift may be run alongside the drilling gallery, or below or above it. According to the basic idea, drilling, charging and igniting take place in the drilling gallery, entirely separated from the scaling and mucking operations proceeding independently in the new drift.

Mr. Janelid is a professor of the Royal Institute of Technology, Stockholm, Sweden. Mr. Olsson is a mining engineer and assistant to Prof. Janelid.

Shotholes may be placed and directed as shown in Fig. 2 where two rows of holes have been drilled from the same gallery to form an angle. This angular pattern produces an angular front which may be preferable on occasion, particularly in tough rock. A major part of the footage drilled will be wasted in the pillars, but this disadvantage is compensated by the increased burden as compared to the pattern in Fig. 1.

Another variation of the method is illustrated in Fig. 3 where the pattern is drilled from two galleries alongside the new drift. This variation is indicated for vertical rooms.

The section of the drift can be outlined rather accurately by proper placing of the holes and by choosing suitable lengths of charge for the different holes. A certain arching, for example, is obtained by making the roof holes shorter and charging them less than the other holes.

The above discussion refers to parallel and level drifts, but the method is applicable also to other mining methods shown in further detail.

## Drilling Method Differs

When drifting according to the Janol method, the drilling differs in many respects from that used in regular drifting, particularly as to length of hole, gage, directional accuracy, and so on. The method facilitates a further mechanization of the drilling, since it is isolated from the other operations of the working cycle. Moreover, the drilling can be carried out in advance according to a simple pattern. Fig. 4 shows in perspective a multi-unit drill being employed in the drilling gallery.

The length of the holes will somewhat exceed the combined width of pillar and drift, and in the most common applications, such as room-and-pillar mining, sub-level caving and the like, the holes are 8- to 15-m long.

The gage of the bit should be 35- to 45 mm to obtain a concentrated charge at both walls of the new drift. Long holes require sectional equipment.

The Janol method demands accuracy in directing the holes. Large deviations must be avoided because burden and charges are calculated on

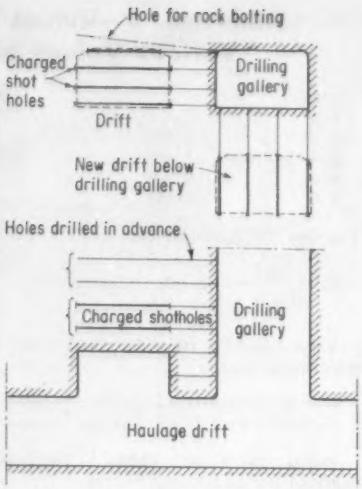



**FIG. 1.** Drifting by the Janol method.

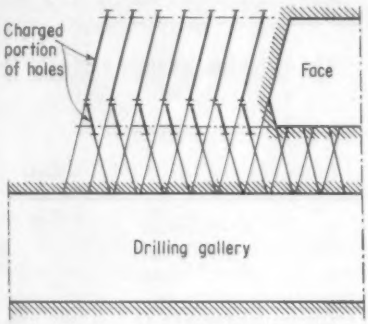



**FIG. 2.** Plan showing drilling method.

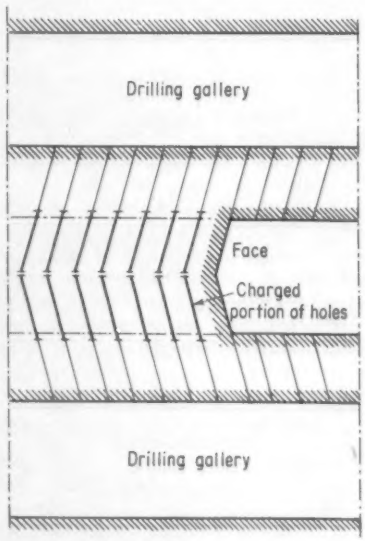



**FIG. 3.** Drilling from two galleries.

the maximum deviation. To obtain maximum effect of the holes and explosives, total deviation must not exceed 1%, or 10 cm in 10 m.

Deviation of the hole will arise from improper positioning of the rock drill, inaccurate collating, and the nat-

ural tendency of the hole to drift. It is therefore necessary to keep errors in drilling as small as possible in order to stay within the accepted tolerance.

Fig. 5 shows the variation of the total footage with the area of the drift and the size of the burden. In this particular case the width of the drift is equal to the width of the pillar. The width of the drift is 1.2 times the height. Four shotholes are used per row. The diagram shows the footage per cubic meter required for conventional drifting as compared to footage used in the Janol method, with four alternatives of burden, i.e. 0.8, 1.0, 1.2 and 1.4 m.

The diagram notes that total Janol footage compared to the conventional becomes less at a burden of 1.0 m and more. In the diagram no consideration has been given to the potential future use of the holes left in the pillar.

## Effect on Powder Consumption

As in stoping, the Janol shotholes are placed parallel to the breakout face. Since in the Janol method there exists only one breakout face, the holes are more constricted than in stoping, and each hole must therefore be given a concentrated charge (equivalent to the bottom charge in benching or stoping) at each side of the drift. For this reason the powder consumption becomes larger than in conventional stoping. However, owing to the more favorable placing of the holes the powder consumption is less than in conventional tunnel advance.

Fig. 6 compares powder consumption per cubic meter in regular drifting, benching, and Janol blasting as a function of the burden. The values for conventional drifting are real, and the others are computed.

Increasing the area reduces the unit powder consumption. Theoretically, in very large areas the consumption approaches that of the benching case, which also happens in regular tunneling.

Increasing the burden results in greater powder consumption. To obtain desired breaks along the sides, concentrated charges must be heavier and extended beyond the section. If the burden is increased beyond a certain limit, the drift will taper regardless of the charges used.

With a given area, increasing the number of holes will reduce the unit powder consumption to begin with, considerably. The contour will also improve and the entire blasting operation will become more reliable.

Advance per round can be extended considerably, compared to conventional drifting, and can be more easily adapted to loading facilities desired. At Kiruna, on one occasion, a 7-m round was blasted, consisting of six rows of holes with a 1.15 burden. The size of the drift was 5x3.5 m.

Outline of the drift can be varied within wide limits. A certain arching can be obtained by charging the roof hole less than the other holes. If hole spacing and burden are kept within reasonable limits, the walls turn out no more uneven than in regular drifting and no damage to the pillar has as yet been recorded.

Concentrated charges at the sides are suitably made with a pneumatic charging machine. The intermediate charges are made up of loosely packed long cartridges. In trials hitherto carried out, except in Kiruna where fuse and cap are used, millisecond blasting caps have been employed. In hard rock, one cap per hole appears to be adequate, but in soft rock the whole charge has on occasion failed to ignite and in such cases a cap of the same number has been placed at both ends

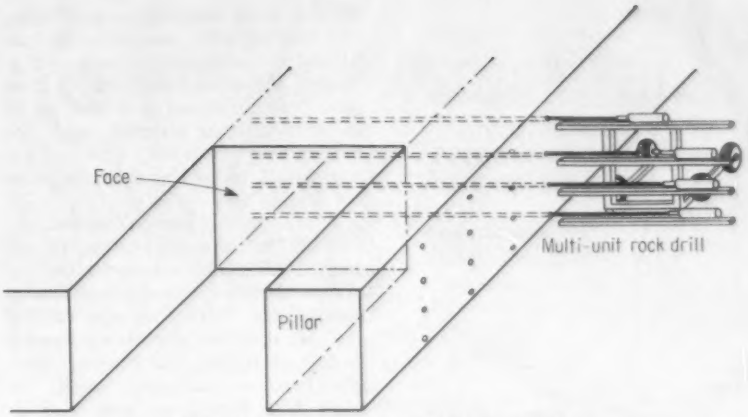



**FIG. 4.** Level drifting by the Janol method.

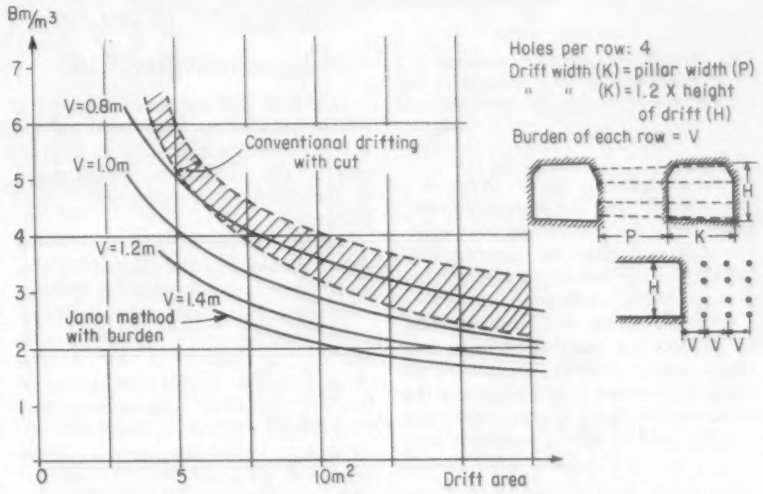



**Fig. 5.** Drilling required (Bm, total meters) per volume broken, as function of drift face area, for conventional cut and for Janol scheme at various burdens.

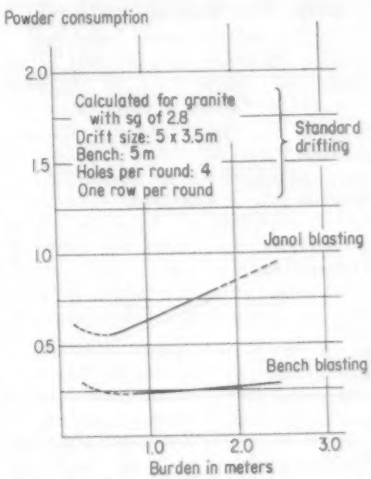



**Fig. 6.** Powder consumption (kg per cubic meter) versus burden for three methods.

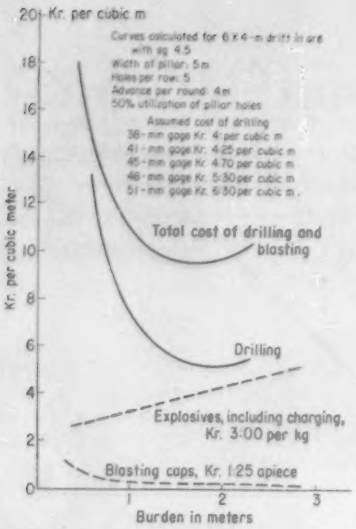

Kr. per cubic m
Curves calculated for 6 x 4 - m drift in ore with sg 4.5
Width of pillar, 5 m
Holes per row: 5
Advance per round: 4 m
50% utilization of pillar holes
Assumed cost of drilling
38 - mm gage Kr. 4 per cubic m
41 - mm gage Kr. 4.25 per cubic m
45 - mm gage Kr. 4.70 per cubic m
48 - mm gage Kr. 5.30 per cubic m
51 - mm gage Kr. 6.30 per cubic m
Total cost of drilling and blasting
Drilling
Explosives, including charging, Kr. 3.00 per kg
Blasting caps, Kr. 1.25 apiece
Kr. per cubic meter
Burden in meters

**FIG. 7.** Drilling and blasting costs per cubic meter broken as a function of the burden in level drifting by Janol method.

of the charge. The middle holes in a row should have the lowest number, followed by the bottom and roof holes. By this sequence the greater constriction of the bottom and roof holes is successfully overcome.

When choosing the Janol method, the burden, the number of holes and other factors bearing on the result should be selected to accommodate the round to the mucking and other operations, and to obtain minimum cost for the entire working cycle. Drilling and blasting costs can be easily calculated in the manner shown in Fig. 7. Here the drilling and blasting costs have been calculated as a function of the burden, using assumed values for the number of holes, advance per round, etc., as well as the unit prices for drilling and explosive.

Increasing the burden reduces the footage, but the gage must be increased to accommodate the heavier charge needed. Since the gage has a considerable bearing on the drilling cost, the optimum burden (in respect to cost of drilling and blasting) usually becomes relatively small. In small drifts having an area of 5 to 7 sq m the burden is usually selected at 0.8 to 1.0 m; in larger stopes, such as the 15 sq m ones used at Kiruna, the burden used is 1.2 to 1.3 m.

## Table 1. Summary of results from mining trials with the Janol method

| | Conventional drifting | | Janol method (incl. pillar holes) |
|---|---|---|---|
| **Skövde** | | | |
| Slate, 6x3.6-m drift | | | |
| Width of pillar, 3 m | | | |
| Footage per cubic meter, m | 1.3 | | 0.85 |
| Explosives per cubic meter, kg | 0.5 | | 0.45 |
| Advance per round, m | 2.8 | | 4.0— |
| **Kiruna** | | | |
| Iron ore, 5x3.5-m drift | | | |
| Width of pillar, 5 m | | | |
| Footage per cubic meter, m | x) 3.06 | xx) 3.36 | 2.20 |
| Explosives per cubic meter, kg | 1.25 | 1.7 | 0.86 |
| Advance per round, m | 1.8 | 3.4 | 7.0 |

x) using air leg drills
xx) using multi-unit drill rig

## Economies Obtained

Practical blasting trials employing the Janol method have been carried out in limestone and slate at Skövde, and in ore at Kiruna, Malmberget, Koskullskulle, Grängesberg and Forsbo.

Table 1 contains a summary of the results obtained in Skövde and Kiruna, as compared to conventional drifting.

Earliest and most comprehensive trials were conducted in slate outside Skövde, on behalf of AB Atomenergi, to obtain a cost comparison of the Janol method with conventional methods as applied to room-and-pillar mining. Estimated output of the operation is about 900,000 tons of uranium slate per year. Calculations based on these trials show that the Janol method is the most economical one for the projected mining of this low-grade uranium deposit.

Slate is easy to drill and blast and only three 42-mm gage holes were required with a burden of up to 1.5 m. In blasting, certain difficulties were encountered, whereby some of the charge in the holes failed to ignite. By using two caps per hole the difficulty was overcome.

The cement company, AB Gullhögens Bruk, is also conducting pilot operations outside Skövde. The company is driving a 7x6-m drift in limestone separated by a 4-m pillar from the drilling gallery. The pattern used is one row of five holes per round with a 1.5-m burden, which is giving satisfactory results. The footage per cubic meter of broken rock is only 0.9 m and the powder consumption 0.6 kg per cubic meter.

At Kiruna, trials are being conducted in 5x3.5-m sub-level caving drifts with 5-m pillars. The first test series of 10 to 15 rows of holes proved that the method could be employed in that particular ore and also served to indicate the burden to be used, as well as the number of holes required and the size of the charges.

At present, Janol rounds are being tried in a more extensive program. Up to the time of writing, some 20 rows have been blasted, using a 1.15-m burden and four holes per row with different size charges. Advances up to about 7 m have been obtained per round. Adequate arching of the roof has been achieved by proper placing of the top hole and suitable distri-

## Table 2. Comparative blasting costs according to the Janol method and conventional drifting

Size of drift: 6x4 m, 24 sq m
Width of pillar: 5 m
Rock: ore with sg of 4.5 t/cubic meter

| | Conventional | Janol |
|---|---|---|
| Gage, mm | 32 | 38 |
| Length of hole, m | 2.0 | 11.4 |
| Advance per round, m | 1.8 | 6.0 |
| Burden, m | varying | 1.2 |
| Number of holes per row | — | 5 |
| Footage per meter of advance, m. | 60 | 47.5 |
| Footage per cubic meter, m | 2.50 | 1.98 |
| Explosives per cubic meter, kg | 1.10 | 0.80 |
| Assumed unit costs | | |
| Drilling cost per meter, Kr. | 2:00 | 2:80 |
| Explosive, including charging, Kr. per kg | 3:00 | 3:00 |
| Milli-second cap, Kr. | — | 1:25 |
| Blasting cap, including fuse, Kr. | 0:40 | — |
| Costs | | |
| 1) Assuming the pillar holes being entirely lost: | | |
| Drilling, Kr. per cubic meter | 5:00 | 5:55 |
| Explosives, Kr. per cubic meter | 3:30 | 2:40 |
| Blasting caps, Kr. per cubic meter | 0:45 | 0:22 |
| Total, Kr. per cubic meter | 8:75 | 8:17 |
| Gain, Kr. per cubic meter | — | 0:58 |
| Gain, Kr. per meter of advance | — | 13:90 |
| 2) Assuming that 50% of the pillar holes will be used at a later date. The value of used pillar holes is estimated to be 2:00 Kr. per meter | | |
| Total, Kr. per cubic meter | 8:75 | 7:30 |
| Gain, Kr. per cubic meter | — | 1:45 |
| Gain, Kr. per meter of advance | — | 34:80 |

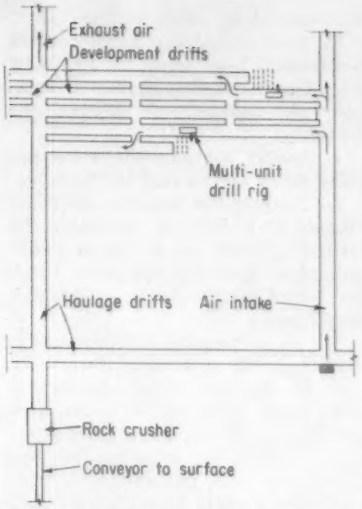



**FIG. 8.** Mining method recommended for low-grade uranium deposit.

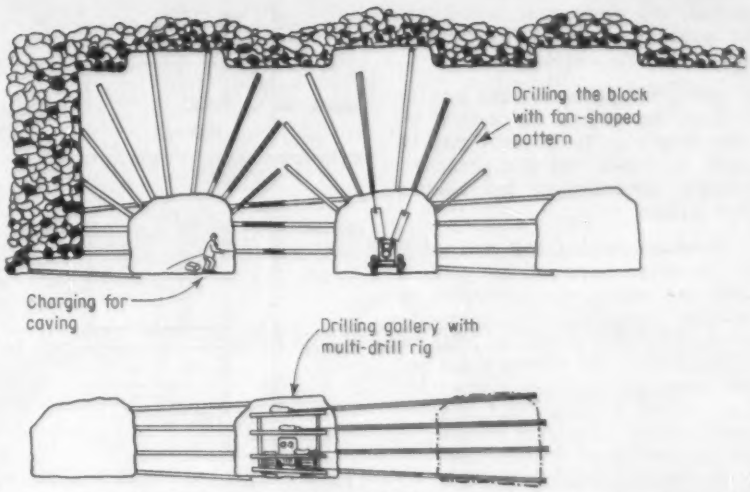



**FIG 9.** Application of the Janol method in sub-level caving operations.

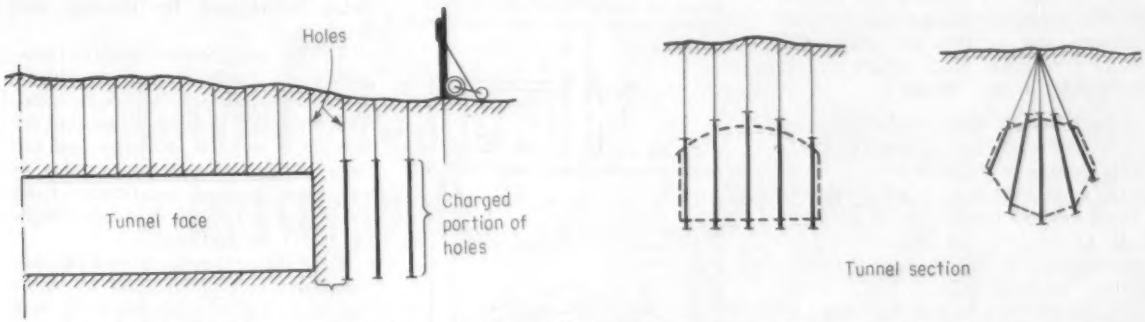



**FIG. 10.** Longitudinal and cross-sections showing application of the Janol method to tunnel driving from surface.

bution of the charges. Walls are as even as in drifts advanced by conventional methods. Drifts show no tendency to taper when using deep rounds.

Table 1 shows that powder consumption and footage have been reduced substantially compared to the methods previously employed. Advance gained per round is also satisfactory, facilitating a more efficient use of available mucking facilities. Finally, some of the holes left in the pillars can be utilized in subsequent operations.

Trials at the Malmberget, Koskullskulle and Forsbo mines are less extensive and are not yet concluded.

## How Costs Compare

Table 2 gives comparative estimates of the Janol method and conventional methods, based on technical data obtained from the Kiruna trials but converted to one and the same area and using assumed rates. Cost per meter drilled hole has been assumed to be higher for the Janol method, as well as the cost of blasting caps. Moreover, the comparison applies only to drilling and blasting, and no consideration has been given to mucking, scaling, ventilation, safety, rate of advance, etc.

Two alternatives are given for the Janol method; in one it is assumed that the holes in the pillar will never be used, in the other that 50% of the holes will be used in subsequent sublevel caving.

In both alternatives, the Janol method gains by Kr. 0:58 and Kr. 1:45, respectively, per cu.m. of broken rock. Expressed in per meter of advance the gains are Kr. 13:90 and Kr. 34:80.

Using the data in Table 2, the cost of drilling and blasting as a function of the burden is given in Fig. 7. From the curves note that for a given burden, there will always be a minimum drilling-blasting cost, which in the example given occurs at 1.3 m. The optimal burden, considering all pertinent factors, as well as the number of rows per round, must of course be determined in each case.

## Applications of Method

Hitherto this discussion has been confined to application of the Janol method to level and adjacent drifts. The method can also be applied to inclined stopes and rooms, whether adjacent, above or below the drilling gallery. A few applications will be briefly mentioned in the following:

**Room-and-pillar mining.** Fig. 8 shows the mining principle recommended for extracting low-grade uranium deposits at Skövde on behalf of AB Atomenergi, as referred to above. However, the Janol method can obviously be employed in conventional room-and-pillar mining where much of the pillar holes can be used for subsequent blasting of pillars. The method can be adapted to advantage in numerous mines using the room-and-pillar method.

**Sub-level caving.** Fig. 9 shows application of the method in sub-level caving. Parts of the holes remaining in the pillars are used. In many mines employing sub-level caving, drifts and pillars are of a size inviting the application of the Janol method as an economical alternative to the methods currently used.

**Tunneling from above ground.** Fig. 10 shows the advance of a tunnel by

drilling from above ground. In one section, the rectangular tunnel has an arched roof, in another the area approaches the circular.

**Shafts and raises.** A raise may be driven from an existing shaft as indicated in Fig. 11. A shaft may be sunk, as shown, but this alternative requires more drilling and blasting than a raise.

**Shrinkage stoping and excavation.** In shrinkage stope mining and, in civil engineering, the excavation of caverns, drilling and blasting may be arranged so that a wall or pillar remains between the drilling winze and the room. In Fig. 12, the room has been drilled from a common winze and (below) from two winzes enclosing the space. Where pillars are to be removed subsequently, they can be made rather heavy, since the holes can be used for blasting the pillars.

The advantage of the method is that drilling and blasting are performed from a secluded place which can be served by a cage or the like.

**Rock bolting.** The principle of using an adjacent drilling gallery facilitates rock bolting of the roof prior to blasting. Rock bolting, according to the Janol method, involves drilling a number of holes above the future roof simultaneously with drilling the shotholes, as indicated in Fig. 13, or outside the shaft or tunnel sections as shown in Fig. 13 (right).

Reinforcement rods may be grouted or anchored by expansion bolts, or when of larger size, simply shoved into the holes and left there as a temporary safety measure. The method has been tried when drifting in slate in order to support loose slabs. When tunneling from above ground, as previously described, the remaining holes can, if required, be utilized for rock bolting.

## Advantages in Brief

The Janol method is more efficient and economical than conventional systems of drifting, tunneling and cavern excavation in cases where the drilling can be performed from an adjacent gallery and when the operation is of adequate scale and the pillar separating the galleries relatively thin. It is particularly well suited to sub-level caving, assuming that the size of the intermediate pillar is reasonable compared with the width of the new drift next to the pillar.

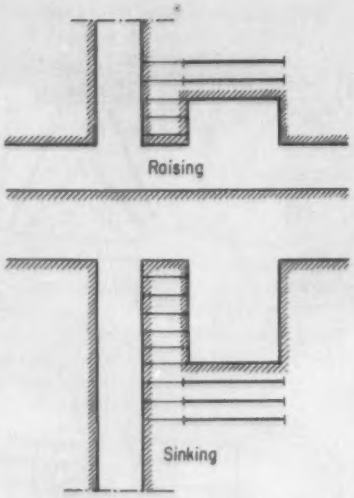



FIG. 11. Raising and sinking rounds.

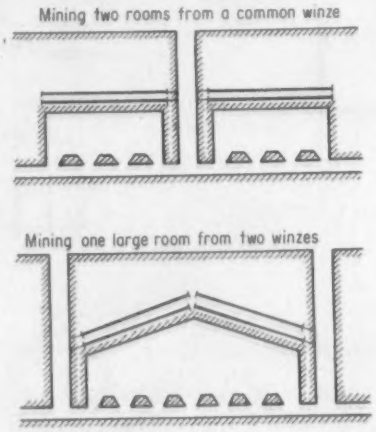



FIG. 12. Shrinkage stope applications.

In cases where the Janol method is indicated, it possesses the following advantages and disadvantages, compared to conventional drifting and tunneling.

1. Powder consumption is less because holes are parallel to the face.
2. Charging the holes is simplified because of fewer holes and since the method permits use of more standardized charges. On the other hand, the length of the holes complicates the charging work.
3. Consumption of blasting caps is smaller.
4. Footage per meter advance is less if the width of the pillar does not exceed that of the drift.
5. Holes in the pillar can be used in certain cases, particularly in sublevel caving or, in tunneling, for rock bolting.
6. Drilling can be done without being interrupted by blasting and mucking.
7. The long holes required constitute a disadvantage, particularly since they need to be accurately sited. This difficulty may be eliminated by the use of suitable drill rigs and fixtures which, because the drilling is performed without interference from other operations, will facilitate a higher degree of accuracy.
8. Mucking can be carried on continuously; only interrupted by blasting, scaling and, when required, rock bolting.
9. Mucking is greatly simplified because the round does not need to be cleaned up close to the face.
10. The roof may be reinforced by bolting with holes drilled above the shotholes from the adjacent gallery prior to igniting the round. When tunneling above ground, the roof and walls may be reinforced before blasting.
11. The round can be ventilated efficiently by blowing air through the left-over holes in the pillar.
12. Charging and blasting is safer if it is performed shielded from and outside the blasting area.

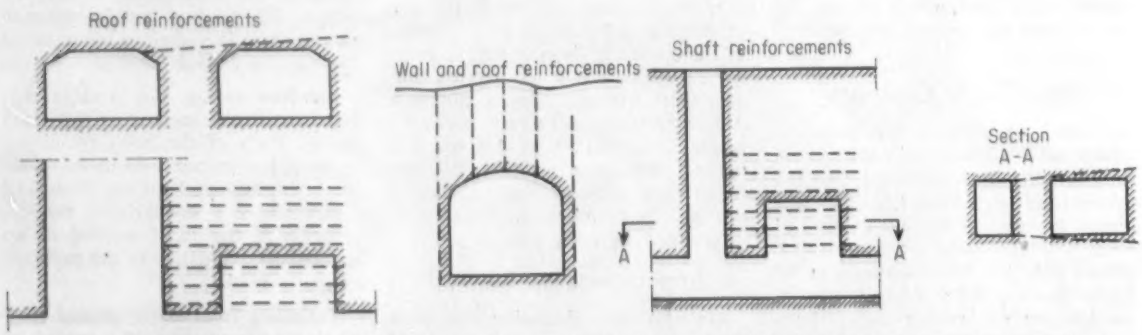
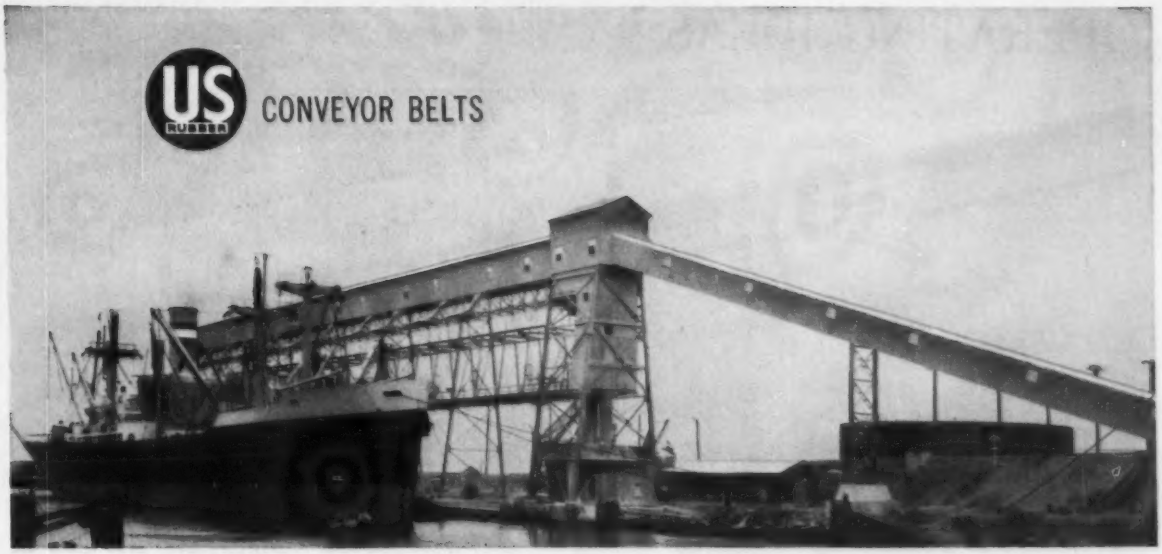
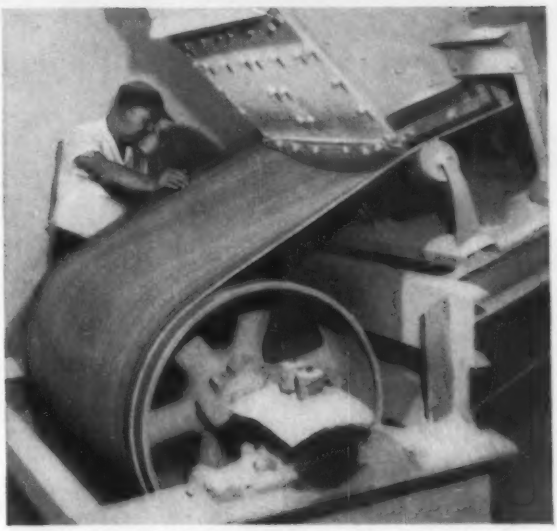



FIG. 13. How the Janol method can be applied to structures where roof-bolting is employed to support ground.




# "Haven't found a better belt than U.S. Rubber,"

## says supt. of terminal



Mr. Holcomb points out that U.S. Rubber Belt is free of defects, despite 12 years of continuous operation, carrying a total of 18 million tons of ore.

It's satisfaction such as this that has made U. S. Rubber the world's largest manufacturer of belts. The Atlantic Coast Line R. R., Port Tampa, Florida, terminal uses 5 "U. S." Belts to transfer phosphate from the mines and triple phosphate from refining plants to ship loading for transportation throughout the world. About 1,500,000 tons are shipped through this elevator every year.

These 5 belts include 3 transfer belts, 1 incline belt, 1 distribution belt. The star of this quintet is the incline belt, which was installed in September, 1946 and to date has carried over 18 million tons of phosphate.

"We haven't found a better belt than U. S. Rubber," says Mr. J. E. Holcomb (superintendent of machinery and stevedores). "We need dependability—the belts may be carrying 1500 tons an hour for several days."

These "U. S." Belts were designed and installed by means of COORDINATED ENGINEERING, in which the engineers of the plant, the builders of the conveyor system and the "U. S." belting engineers COORDINATE to make sure of the best possible system for the job.

• • •

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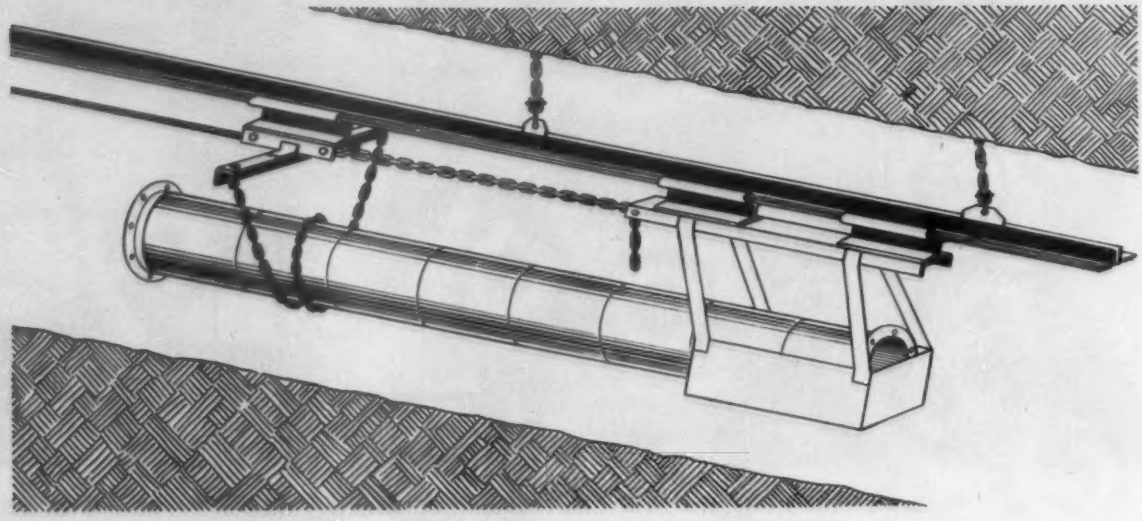
# OPERATING IDEAS



## Simple Monorail Carrier Replaces Incline Skid Car at Premier

A MONORAIL SLIDE, capable of carrying 1,000-lb material between working levels, has been installed at the Premier diamond mine, South Africa.

Before the introduction of the monorail, according to a recent edition of Anglo-American's OPTIMA, material and equipment were moved through an incline in a 15-ft steel-plated skid car which ran on a permanent skidway. The skid car was operated by a 25-hp electric single-drum winch located at the top of the incline.

"This somewhat elaborate arrangement," said OPTIMA, "has been greatly simplified by the introduction of the monorail system. Instead of the heavy skid car, a light carrier made of welded mild steel plate, is used. The carrier is suspended from a single rail attached to the hanging wall of the incline.

"The rail consists of angle irons (measuring 3x3x⅜ in.) in lengths of 30 ft laid back to back and bolted together at intervals of 7½ ft by means of hanging plates. Palm bolts (1⅛ in.) are wedged into the hanging wall above these plates; chain, between 1- and 2-ft long to suit the variations in the hanging wall, is attached to each bolt. Hook bolts screwed into supporting forks, which are bolted to the hanger plates, provide a means of aligning the rail in the vertical plane.

"The carrier is suspended from two sliding stoppers by flat iron hangers inclined at 30 deg to prevent a bending movement. An auxiliary stopper, about 12 ft ahead of the carrier, is attached to the carrier by a length of chain to enable long material to be transported.

OPTIMA ended its presentation by pointing out that the monorail system was ideal for "light duty" inclines where the amount of equipment carried would not justify more elaborate and expensive installations.

## Thin Steel Forms Replaced Timber for Concreting a Deep Shaft

EXTREMELY "THIN" STEEL FORMS, measuring only 5 in. from skin plate to stiffener ring, are being used in vertical shaft construction—concreting a 3,000-ft deep iron mine at Iron River, Mich.

The 20-ft dia shaft is being built for M. A. Hanna Co. by Walsh Construction Co., New York, which is using six identical 5-ft deep sections of forms designed and built by Blaw-Knox Co. The sections are bolted together to make a 30-ft high unit.

Hanna decided on steel to hold runners for hoist skips—rather than conventional wood timbers. Aside from structural strength provided the steel by concrete, it also furnishes waterproof advantages for the "dry" shaft.

According to Blaw-Knox, the steel forms enable the contractor to place concrete 18-in. thick at a rate of 60 ft per week. Specifications call for 8,490 cubic yd of concrete in the shaft.

Virgil C. Calaway, Walsh project engineer, says the forms are moved from one position and set in another in 4 hours through use of anchor bolts for staging beams. As the shaft progresses, staging beams are installed at 10-ft intervals. Each 5-ft deep section of the bolted 30-ft form unit features a series of 18x24-in. hinged door openings—through which anchor bolts are set at the required interval.

Anchor bolts, set in the form during concreting, support the final shaft staging. Same bolts, however, serve to support registering beams which prevent forms from rotating out of position. Another feature is that the same bolt pattern is used to suspend forms from the previous pour by heavy clamp-chain combinations. All of the bolt setting and stripping work is done from inside the forms. Mr. Calaway claimed that the form-setting part of the operation is now being done in about two-fifths of the time formerly required.

Two steamboat ratchets strip the 30-ft high form units. A complete unit is then lowered in a single operation.

After the forms have been positioned, concrete is placed. It usually takes about 8 hours to pour the required 130 cubic yd. Then, steel spreaders are placed in the concrete at the start of a three-day setting-up period. While concrete is setting, miners sink another 30 ft below the forms.

A conical bulkhead at the bottom of the forms serves as a blast deflector ring—since blasting is carried on during excavation. Also, each 5-ft section of the forms includes a 1-ft heavy box rib for additional strength during blasting.

A total of 40,000 cubic yd of muck is being excavated from the shaft at a rate of 300 cubic yd per day. Excavation is progressing at about 8 ft per day since a complete use cycle of the Blaw-Knox forms requires 4 days, including 3 days for setting of concrete.

Mr. Calaway says that the forms have never been taken from the shaft during construction. However, he points out, they could be removed quite easily.

After more than 2,000 ft of shaft construction, Mr. Calaway reports damage to only one secondary stiffener member in the bottom 5-ft form section, a section subject to severest use.

B.F.Goodrich

# It's a rugged, rock-strewn strip mine—the place where B.F.Goodrich tires pay off!

TON after ton of rock and overburden crash into that truck, to be hauled out of this Pennsylvania strip mine on a road littered with jagged rock. Trucks work 70 hours a week. Gross loads reach upwards of 44 tons. Sky-high tire costs? Not for this company. They use B.F.Goodrich Rock Service tires. The company reports Rock Service tires give as many as 3,000 hours of service on the original tread—can still be retreaded twice!

B.F.Goodrich builds the Rock Service with a special cut and snag-resisting tread compound. Double-chevron cleats grip the ground, defy dangerous skids. You get more retreadable tires with Rock Service tires, thanks to the B.F.Goodrich FLEX-RITE NYLON cord body. This B.F.Goodrich nylon withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. No wonder strip mining is a place where Rock Service tires really pay off!

Visit your nearby B.F.Goodrich Smileage dealer today. He has tires for every kind of mining job—tires that will save you money. *The B.F.Goodrich Company, Akron 18, Ohio.*

**Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment**

## B.F.Goodrich *off-the-road tires*

# PERSONALS

**William D. Baker** has resigned as general superintendent of the Parral Unit of American Smelting & Refining Co., Parral, Chihuahua, Mexico. He will return to the U.S. and set up a consulting practice. Box 235, Ajo, Ariz.

**R. L. Moxham** has won the Walker Mineralogical Club's 1958 Peacock Memorial Prize of $200 "for the best scientific paper on pure or applied mineralogy, including crystallography, mineralogy, petrology, ore genesis, and geochemistry" submitted by a graduate.

Moxham's paper was "Minor Element Distribution in Some Pyroxenes of Metamorphic Origin." He did his work under professor **Dennis M. Shaw,** geology department chairman, Hamilton College, McMaster University.

**R. E. Stavert** has been elected chairman of Consolidated Mining & Smelting Co. of Canada Ltd. and **W. S. Kirkpatrick** will be the new president. The company also announced that **N. R. Crump** and **R. Hendricks** were elected respectively vice president and executive vice president. **F. L. Hallam** was chosen secretary-treasurer.

From Trail, Cominco reported the appointment of **Lloyd Williams** as assistant manager of the engineering division.

**Frank Coolbaugh** has become president of the Climax Molybdenum Co., Div. of American Metal Climax, Inc. He succeeds **Weston Thomas** who recently became executive vice president of the parent organization.

**Coolbaugh**

In 1953, Coolbaugh was named resident manager at the Climax mine and, a year later, was made general manager of all company mining operations. He became vice president—western operations in 1956 and a member of the board of directors the following year. When Climax joined with American Metal Co., Ltd., Coolbaugh became a vice president and a director of the merged company.

Mr. Coolbaugh also serves as president and director of Climax Uranium Co., San Antonio Mining Co., St. Anthony Mining Corp., and Climax Molybdenum Co. of Pennsylvania. He is a vice president and director of Climax Molybdenum Co. of Michigan.

**John D. Bradley,** president of the Bunker Hill Co., has been re-elected to a second term as president of the Lead Industries Association. He was also named chairman of the board of the L.I.A. and chairman of the association's executive committee.

**W. A. Green** has been elected to the new position of executive vice president of Hudson Bay Mining & Smelting Co., Ltd., as announced by **C. V. Whitney,** chairman and president.

Mr. Green has been a vice president and a director of Hudson Bay since Ocober 1956. He was with the company when it was organized in 1927 and has served as general superintendent and general manager.

**Max J. Kennard,** manager of the engineering and construction division of Southwestern Engineering Co., Los Angeles, has been elected vice president of the company.

**Robert P. Miller,** president of Southwestern, said that Kennard will have the responsibility for administration, purchasing, engineering and construction functions for varied refinery, chemical, and other industrial projects of the division.

**R. G. Kenly** was recently elected president of the American Zinc Institute. He is a vice president of the New Jersey Zinc Co.

Other elected officers were three vice presidents: **T. A. Campbell,** Anaconda Sales Co., N.Y.C.; **H. D. Carus,** Mathiessen & Hegeler Zinc Co., LaSalle, Ill. and **E. H. Snyder,** Combined Metals Reduction Co., Salt Lake City. Re-elected were **G. H. LeFevre,** U.S. Smelting, Refining & Mining Co., as treasurer and **J. L. Kimberley,** executive vice president and secretary.

Directors elected for the term expiring 1962 were; **Victor C. Allen,** Tri-State Zinc, Inc.; **Andrew Fletcher,** St. Joseph Lead Co.; **C. R. Ince,** St. Joseph Lead Co.; **F. R. Jeffrey,** National Zinc Co.; **G. H. LeFevre,** U.S. Smelting, Refining & Mining Co.; **E. S. McGlone,** Anaconda Co.; **J. S. Smart, Jr.;** American Smelting & Refining Co.; **E. H. Snyder,** Combined Metals Reduction Co.; **S. D. Strauss,** American Smelting & Refining Co.; and **Jean Vuillequez,** American Metal Climax, Inc.

**T. A. Campbell,** Anaconda Sales Co., and **W. G. Woolf,** Bunker Hill Co. were elected directors to fill vacancies on the board for the term expiring 1960.

**Robert C. Bacon** has been named superintendent of operations of Braden Copper Co., Chile.

**Bacon**

Bacon was formerly vice president of Ventures, Ltd., assistant to the manager, Rosenhine interests in Peru, and mine superintendent, Vanadium Corp. of America, in Colorado. He was also associated with Cerro de Pasco Corp and W. R. Grace & Co., Peru, C. F. Braun & Co., New York, and South American Development Co. in Ecuador. Altogether, he has spent some 20 years in Latin America.

**J. M. Oleson** was recently elected executive vice president of Lyon Metal Products, Inc.

Oleson started in Lyon's sales division in 1929. He was made steel fixture division manager in 1939, assistant sales manager in 1942, and manager of the steel equipment department in 1946. In 1950 he became general sales manager, was elected vice president in charge of sales in 1952, and a board member in 1955.

**Marcel Lecompte,** International Nickel Co. miner who risked his life to rescue a partner from a stope blast, has received the Canadian Institute of Mining & Metallurgy's gold medal for bravery.

Lecompte and his partner, **Nick Duda,** were loading and lighting a round of holes in Inco's Levack mine. One shot of the blast fired, knocking Duda unconscious, while fuses were burning in the other 25 holes of the round. About to escape by the manway, Lecompte went back and took Duda down 14 ft of ladders to safety on the gangway seconds before the blast went off.

**H. A. "Bud" Archer** has been named senior service metallurgist in the Denver sales office of Columbia-Geneva Div. of U.S. Steel. Archer joined USS in 1940, and in 1955 was appointed service metallurgist in the San Francisco Central sales district office of C-G.

**George L. Spencer,** St. Louis, has been elected a vice president of the American Zinc, Lead & Smelting Co., according to president Howard I. Young.

**Spencer**

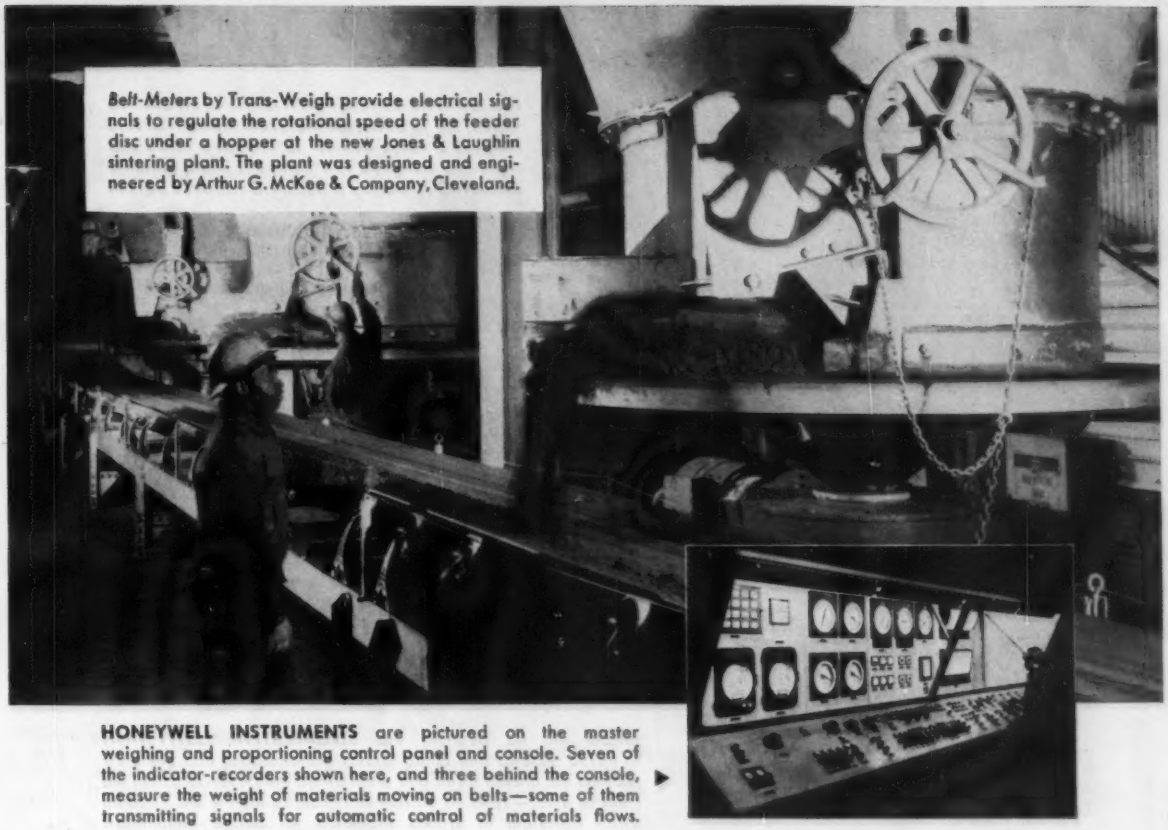
Spencer has served as a vice president of a subsidiary, American Zinc Co., of Illinois, since November 1955.

In 1927, Mr. Spencer joined the metallurgical staff of American Zinc's Fairmont City, Ill., plant. He was transferred to the Hillsboro, Ill., zinc pigment operation as plant manager in 1930 and served in that capacity until 1936. From 1936 to 1940, he directed process development in connection with zinc, cadmium, and zinc pigments at the firm's East St. Louis, Ill., and Columbus, Ohio, operations. From 1940 until 1955 he was general superintendent of the Fairmont City operations.

**Sam Wilkins,** who started his career in mining as a carpenter at Leadville, Colo., has retired after 50 years service with American Smelting & Refining Co.

**D. H. Williams, Jr.,** who has been serving as assistant to the president, Yuba Consolidated Industries, Inc., is now appointed vice president, marketing. His office will be located at the company's new marketing and engineering development center in Palo Alto, Calif.

*(Continued on p. 154)*



*Belt-Meters* by Trans-Weigh provide electrical signals to regulate the rotational speed of the feeder disc under a hopper at the new Jones & Laughlin sintering plant. The plant was designed and engineered by Arthur G. McKee & Company, Cleveland.

**HONEYWELL INSTRUMENTS** are pictured on the master weighing and proportioning control panel and console. Seven of the indicator-recorders shown here, and three behind the console, measure the weight of materials moving on belts—some of them transmitting signals for automatic control of materials flows. ▶

# Sinter mix automatically weighed and proportioned at Jones & Laughlin plant

## Honeywell *instruments control continuous process*

There's no time out for weighing materials at Jones & Laughlin Steel Corporation's 2,500 ton-per-day sintering plant in Cleveland. An automatic system weighs iron ore fines, coke breeze and flue dust, and feeds them in exactly right amounts to the sintering machine. The *Belt-Meter*® system, supplied by Trans-Weigh Company, King of Prussia, Pa., features a continuous electrical weighing technique and uses Honeywell instruments to control and proportion flow rates of materials as they move along a short section of belt.

The system consists of three main parts: (1) an electric tachometer to measure belt speed, (2) an electric strain gage load cell to measure belt load, and (3) an *ElectroniK* potentiometer to indicate and record flow of materials in tons per hour. In addition, a magnetic amplifier controls flows from table feeders. Twelve automated weighing units check materials as they move through every important phase of the sintering process. Operators can vary ratios and switch to manual control when desired.

You'll find Honeywell instruments controlling virtually *every* type of process in the modern steel mill . . . improving productivity, keeping quality standards high, and bringing important day-to-day economies. Your nearby Honeywell field engineer can help you gain these advantages in your own plant. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

**Honeywell**

H HONEYWELL *First in Control*

# NEW BOOKS

## United Nations Second Geneva Conference Proceedings

DOCUMENTS from the United Nations Second Geneva Conference may be obtained through the local sales representative in each country, or through the United Nations Sales & Circulation Section, New York, N. Y. In the U.S., United Nations documents may be purchased from International Documents Service, Columbia University Press, 2960 Broadway, New York, N. Y.

Here are abstracts of five of the thirty-three volumes just published on the Second Geneva Conference held last fall (1958).

**Volume 2,** Survey of Raw Material Resources. Contains over 100 papers on raw materials, supplies, geochemistry, mineralogy, geology, and prospecting. Data on reserves are given. Illustrated in 843pp. Price $18.50.

**Volume 3,** Processing of Raw Materials. Contains articles on prospecting, mining, ore dressing, leaching, solvent extraction. One interesting item is a Russian method of extracting uranium from natural waters. Illustrated in 607pp. Price $15.

**Volume 4,** Production of Nuclear Materials and Isotopes. Production of uranium chemicals, salts, metals and isotopes. Illustrated in 631pp. Price $16.50.

**Volume 30,** Fundamental Physics. Contains the significant advances in physical fundamentals since the first Geneva conference. Illustrated in 329pp. Price $10.50.

**Volume 31,** Theoretical and Experimental Aspects of Controlled Nuclear Fusion. Plasma physics, details of important problems facing economic controlled fusion, high temperatures, machines, etc. are presented. Illustrated in 390pp. Price $15.

### Book Reports

**Mining Year Book, 1959,** by Walter E. Skinner. Usual fine job of compiling data on 950 top mining companies of the world. Includes mining managers section, world production tables for past ten years and buyers guide. Published by Walter E. Skinner, 20 Copthall Avenue, London E. C. 2, England. Price 816pp. Price $7 post free.

**Steel in the Soviet Union,** by the American steel and iron ore delegation from their visit to the Soviet Union in 1958. Published by the American Iron & Steel Institute, 150 East 42nd St., New York 17, N. Y. 376pp. Price $5.

**Russian For the Scientist,** by John and Ludmilla Turkevich. Language course organised to give scientists and engineers a rapid route to the understanding of Russian scientific literature. Published by D. Van Nostrand Co., Inc., Princeton, N. J. 255pp. Price $5.95.

**Second Symposium on Coal Preparation,** edited by the Dept. of Mining, University of Leeds. Available from Powney-Parker Publicity Services, Ltd., Advertising House, Lumb Lane, Bradford 8, England, or through Preparation Plant Association, P.O. Box 121, 301 Glossop Road, Sheffield, 10, England. 510pp. Price 20s post free.

**Optical Mineralogy,** by Paul F. Kerr. Third edition of the text based on the use of the polarizing microscope. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 36, N. Y. Illustrated in 425pp. Price $8.50.

**Conserving Natural Resources,** by Shirley Walter Allen. Second edition. Published by McGraw-Hill Book Co., 330 West 42nd Street, New York 36, N. Y. Illustrated in 360pp. Price $6.75.

**Mineralogy,** by Edward H. Kraus, W. F. Hunt and L. S. Ramsdell. Fifth edition published by McGraw-Hill Book Co., 330 West 42nd Street, New York 36, N. Y. Illustrated in 666pp. Price $9.

**Silhouettes of Charles S. Thomas — Colorado Governor and U.S. Senator,** by Sewell Thomas. Famous episodes of the Goldfields days, interesting reading. Published by Caxton Printers Ltd., Caldwell, Idaho. 226pp. Illustrated. Price $7.50.

**BOOKS** presented on this page may be obtained directly from the publisher mentioned in each case. E&MJ does not sell books.

**Survey of Mines, 1959,** 33rd annual edition. The FINANCIAL POST's usual detailed job on the activities of all the active mining companies in Canada—plus up-to-date maps, eight-year stock price ranges, mineral production going back to 1858. Published by the FINANCIAL POST, 481 University Ave., Toronto 2, Ont. 408pp and maps. Price $4.

### U.S. Bureau of Mines

• Application for the following free literature should be made to the address listed below. Because of the limited editions, only one copy of any particular edition can be sent to any one person, and only a modest number of a variety of publications can be furnished to an applicant. Please order only those publications actually needed. Publications Distribution Office, U.S. Bureau of Mines, 4800 Forbes St., Pittsburgh 13, Pa.

**Report of Investigation 5426,** Practical Evaluation of Electrical-Resistivity Surveys as a Guide to Zinc-Lead Exploration Drilling, Badger-Peacock Camp and Vicinity, Cherokee County, Kansas, by L. C. Brichta and J. P. Ryan. Maps and illustration in 91pp.

**Report of Invest'gation 5433,** Recovering Mercury From Cinnabar-Stibnite Ore by Flotation and Fluidized-Bed Roasting, by R. R. Wells, M. M. Johnson and F. T. Sterling. 19pp.

**Report of Investigation 5442,** Acid-Ferrous Sulphate Leaching of Low-Grade Manganese Carbonate and Oxide Ores, Cuyuna Range, Minnesota, by H. Dolezal and H. C. Fuller. 27 pp.

**Report of Investigation 5469,** Volatilization of Tin Chloride From Bolivian Slimes, by K. K. Kershner and A. A. Cochran, 12pp.

**Report of Investigation 5465,** Conversion of Nicaro Nickel Oxide to Nickel Metal, by W. M. Mahan, N. B. Melcher, J. P. Riott and E. J. Ostrowski. 36pp.

**Information Circular 7860,** A Reconnaissance of Asbestos Deposits in the Serpentine Belt of Northern California, by F. J. Wiebelt and M. Clair Smith. 52pp.

**Information Circular 7870,** Mining Methods and Costs at the Holden Mine, Chelan Division, Howe Sound Co., Chelan County, Washington, by John R. McWilliams. 44 pp.

**Information Circular 7871,** Lode-Tin Mining at Lost River, Seward Peninsula, Alaska, by S. H. Lorain, et al. 78pp.

**Information Circular 7879,** Sinking Methods and Costs at the Burgin Shaft, Bear Creek Mining Co., East Tintic Project, Utah County, Utah, by F. D. Everett. 26pp.

**Information Circular 7881,** Cadmium, a materials survey, by R. L. Mentch and A. M. Lansche. 41pp.

### U.S. Geological Survey

• Professional Papers and Bulletins from U.S. Geological Survey, as listed below, may be obtained from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C. Remittance should be made by money order.

**Bulletin 1019-M,** Annotated Bibliography on the Geology of Selenium, by Gwendolyn W. Luttrell. 105pp. Price 50c.

**Bulletin 1028-I,** Geology of the Delarof and Westernmost Andrean of Islands, Aleutian Islands, Alaska., by G. D. Fraser and H. F. Barnett. 37pp. Price unlisted.

**Bulletin 1028-H,** Geology of Little Sitkin Island Alaska, by G. L. Snyder. 41pp Price unlisted.

**Bulletin 1042-R,** Geology of the Ord Mine, Mazatzal Mountains Quicksilver District, Arizona, by J. N. Faick. 13pp. Price $1.

**Bulletin 1042-S,** Geology and Fluorspar Deposits, Big Four Fault System, Crittenden County, Kentucky, by G. C. Hardin, Jr. and R. D. Trace. 24pp. Price unlisted.

**Bulletin 1045-E,** Core Logs From Searles Lake, San Bernardino County, California, by D. V. Haines. 178pp. Price $2.

**Bulletin 1058-B,** Geology and Ore Deposits in the Reid Inlet Area, Glacier Bat Bay, Alaska, by D. L. Rossman. 25pp. Price 65c

**Bulletin 1058-C,** Geology of Geikie Inlet Area, Glacier Bay, Alaska, by J. F. Seitz. 59pp. Price unlisted.

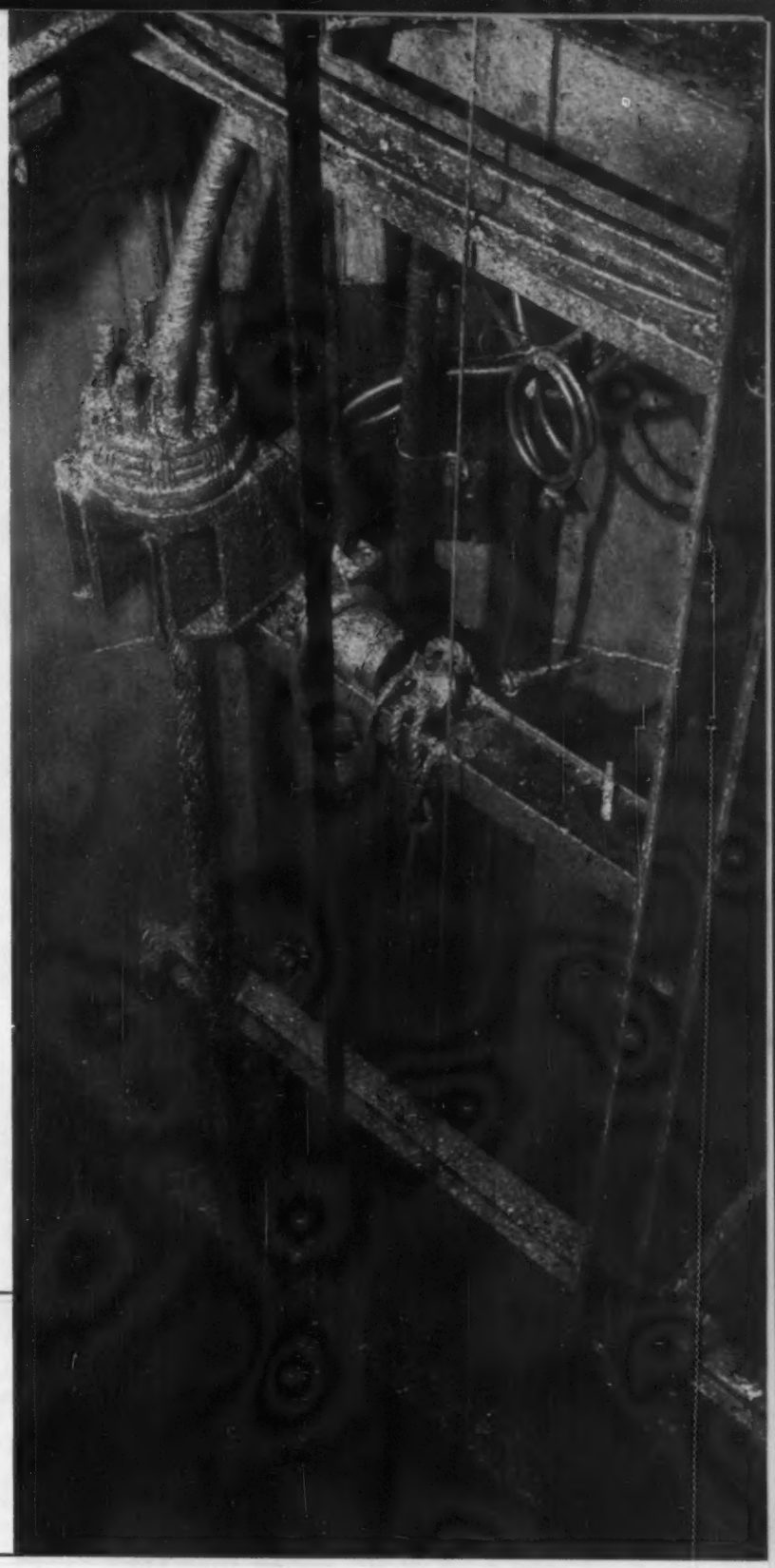
**Bulletin 1072-B,** Barite Resources of the U.S., by D. A. Brobst. 63pp. Price 40c.

# Continuous production hangs on this shaft cable

Falling in unbroken, near-record drops of **one-third of a mile** each, two Okolite 5kv, strip-insulated shaft cables carry every bit of power down two separate shafts to Intermountain Chemical Company's vast trona mine in Westvaco, Wyoming . . . to operate diggers, loaders, conveyors, hoists, lights and blowers. Production, profits—and **lives**—depend on the absolute reliability of these cables.

"The cables are continually drenched by condensing moisture," says Jack Wilson, Intermountain's Maintenance Supervisor. Great length of the suspension puts tremendous vertical pressure on the cable components. Considering their importance as well as the tremendous job of replacing them, Intermountain naturally wanted the most reliable, longest-lived cable they could get. Those were two good reasons for choosing an Okolite-insulated construction.

For **your** circuits that must not fail . . . be sure to call in Okonite. For information on choosing the right cables for your jobs . . . write for free Bulletin EM-1117, The Okonite Company, Passaic, New Jersey.



**NEAR-RECORD CABLE DROPS**

**length:** 1700 feet in each shaft

**suspension:** from a single clamp at shaft collar

**construction:** 3/c, 5kv, Okolite-insulated by strip process, with galvanized steel armor overall

**weight:** 19,000 lbs. each

**tested:** by 40,000 volts DC each

**circuit and load:** 4,160 volts from termination of Okolite-Okoprene aerial cables to power centers in mine

*where there's electrical power . . . there's* **OKONITE CABLE**

6217

# THIS MONTH IN MINING (*Continued From p. 18*)

**HEEL SYSTEM** of smelting is used at the Alton, Ill. plant. Operator, above, removes dross from molten aluminum.

**SPECIAL CASTING** techniques produce ingots of either 16-lb or 30-lb weight. Plant has 72-million lb annual capacity.

## Asarco Brings in Largest Aluminum Scrap Smelter

AMERICAN SMELTING & REFINING CO. is now in volume production of aluminum alloys at its new secondary aluminum smelter, largest ever built specifically for the conversion of aluminum scrap into alloy ingot, in Alton, Ill.

The Alton plant has a production capacity of 72-million lb of aluminum ingot annually. George M. Baumann is manager of the new plant, which is being operated by Asarco's Federated Metals Division.

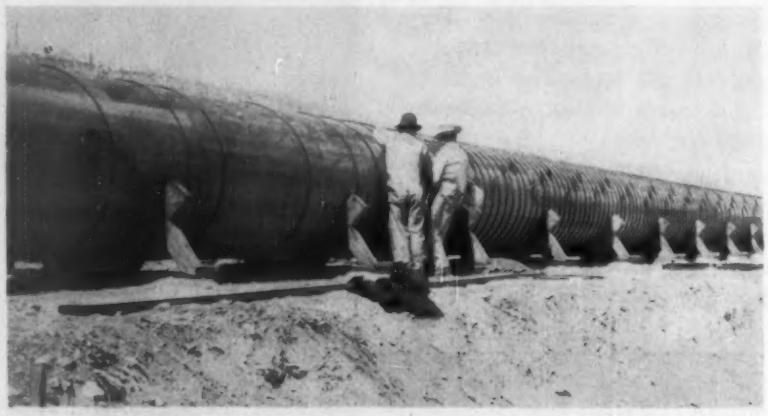
Incoming scrap, which is delivered by rail or truck, is received at unloading platforms which can accommodate seven railroad cars and 12 trucks simultaneously. Nine mobile loaders transport the scrap to storage areas.

Scrap entering the production cycle is sorted and transported in tote boxes, which are moved from process to process by a fleet of 14 fork lift trucks, each equipped with short wave radio receivers and controlled from a central radio dispatch office. To assure adequate supplies of secondary scrap for production lines, 2400 tote boxes, each measuring 4x5x4 ft, are used. High speed conveyor belts transport scrap through crushing, sorting and cleaning processes, which are almost entirely mechanized.

Smelting and alloying operations are handled by four 40-ton and one 15-ton gas-fired reverbertory furnaces, all convertible to oil if required. The heel system of smelting is employed, and special scrubbing equipment has been installed to remove objectionable fumes and dust from furnace exhaust gases.

Three ingot casting machines, which employ special casting equipment and techniques, produce ingot with a minimum of oxidation and with a high quality of finished appearance. Semi-automatic stacking units prepare the ingots for immediate shipment or for storage in rooms equipped with temperature and humidity controls.

Quality control is an integral part of production, from scrap handling through pouring. At every step in the production cycle, a complete analysis of any alloy can be obtained within 10 minutes. Routine analyses on furnace melts are taken at hourly intervals and, as cast-out time approaches, at 15-minute intervals.



**MAGNA MILL'S** re-use water used to be contaminated on return from tailings pond. New pipeline runs 14,900 ft around the pond, returns water to the mill.

## Wood Piping Installed to Improve Milling

UTAH COPPER DIV. of Kennecott Copper Corp. has installed a new $750,000 water circulating system to insure better return of milling water at its tailings pond near Magna, Utah.

The project included construction of a 54-in. redwood pipeline or flume from the dewatering boxes at the northeast side of the tailings pond, a distance of 14,900 ft around the pond, to the No. 1 pumping station near the building.

The line will replace the open canal previously employed to return tailings pond water for re-use in the mill. Water in the canal was constantly being affected by influx of waste waters which caused purification problems in the mill, according to P. H. Ensign, superintendent of mills.

*News continues on p. 100*

Notice how much this big new Michigan looks like the smaller Michigans you see everywhere. It handles as easily as they do, too—with power steer, power-shift, torque converter, planetary wheel drive-axles standard. Its entire all-Clark power train is the same design as that job-proved in the 10,000 Michigans now in the field.

# 6 YARDS PER PASS

**A ten or twelve yard tandem-axle truck loaded in 60 seconds!**

**Two 23-ton semis heaped in three or four minutes!**

**Two passes for the smaller truck, five for the two bigger ones combined.**

Someone's dream? Not any more! It's been standard practice at Stony Creek Stone Company's pit near Indianapolis for over two years now. That's when their big 6 *yard* Model 375A Michigan Tractor Shovel went to work.

Stony Creek's problem up until then had been a common one: "How to hold down loading costs, and reduce truck waiting time in the face of rapidly-expanding demands." Fast rubber-tired Tractor Shovels had long since replaced cranes and crawler-loaders. The biggest rubber-tired units available, 2¾ yds, were in use. But, production requirements were calling for still more loading capacity. At that point, Company General Manager Dick Irving saw the new 6 yard Michigan. "There," he thought, "is a Tractor Shovel that could give us enough capacity to replace two smaller Tractor Shovels *plus* handle all the expansion we anticipate for years to come."

Today, the big Michigan and its *one* operator do the work of *two or more* 2¾ yd Tractor Shovels. Michigan output averages 2,500 to 3,000 tons of crushed limestone every day. "Despite its size, I'd rather run this big Tractor Shovel than any other," says Operator Carroll White. "It handles easily. It moves and responds just as fast as any smaller loader. Its smooth ride sure cuts down on the fatigue you'd expect from a 10-hour day—even though I alone load as much stone as two men did when the pair of 2¾ yard rubber-tired Tractor Shovels were working."

## 4 or 5 passes heap 2 semis

And that's another reason management prefers the 375A. Higher production! With the smaller machines, operators needed at least four minutes to load one 23-ton haul truck. With the Model 375A, operator regularly loads *two* 23-ton semis in the same time—or less!

## Efficiently loads small trucks, too

Operators even prefer to load *five-yard trucks* with the 6-yard Michigan. Here, the Tractor Shovel bucket is allowed to extend beyond the back end of the truck when dumping. May *sound* wasteful, but before the loaded truck can shift into second, one quick swipe of the Model 375A bucket has cleaned all spillage.

Stony Creek Stone Company figures their big new Michigan has thus cut loading costs "more than 50%." Perhaps 6 yard "bites" can do the same for you. Talk it over with your Michigan Distributor soon.

Michigan is a registered trademar of

**CLARK EQUIPMENT COMPANY**
**Construction Machinery Division**

CLARK EQUIPMENT

2465 Pipestone Road
Benton Harbor 10, Michigan

In Canada:
**Canadian Clark, Ltd.**
St. Thomas, Ontario

# Howard Young Foresees Improved Zinc Market

"LOOKING TO THE FUTURE, we consider prospects for the zinc industry most promising and fully expect that as a result of recently activated research and development program, the domestic use of slab zinc and other zinc products will be increased at a rate of from 3% to 4% a year and the price will, within a reasonable length of time, be advanced by 15% to 20% above present levels."—In these terms Howard Young, president of American Zinc Lead & Smelting Co., summarized the immediate outlook for zinc before the New York Society of Security Analysts in New York City on June 4.

He said world production outside the U.S. has increased at a rate of 9.4% per year during the past 10 years, whereas in the U.S. it has increased at an average rate of 3% per year during the same period. He expressed confidence that the centralized research and development program, sponsored by the American Zinc Institute in cooperation with zinc producers in Canada, England, Africa, Australia, Peru and Mexico would contribute to better demand.

Other comments about the current activities of American Zinc made by Mr. Young appear in brief as follows:

**Progress in Mechanization.** Development of mechanized Gismo mining has enabled American Zinc to operate the Grandview mine in Metaline Falls with an average of 69 men during 1958. In 1950, prior to mechanization, 144 men were required to produce approximately the same tonnage of ore as produced in 1958. Further efficiency is expected with introduction of the Transloader during 1959.

A comparison of production at the new mechanized Young mine in Tennessee with that at the older No. 2 mine indicates a 75% increase in tons per man shift through introduction of the Gismo and Transloader.

Mechanization of the Dumas, Texas, smelter which involved an expenditure of more than $1-million has increased output per man shift by 33% since 1950. During the same period labor pay has been increased by 30 to 35%, but costs of labor per ton have been reduced 10%.

**Company Acquisitions.** During the past three years, the company has purchased mineral rights in 8,157 acres of Tennessee land. The company now owns in fee and mineral rights approximately 17,000 acres, and has under option an additional 3,000 acres which are currently being prospected by surface drilling.

In 1957 American Zinc acquired full ownership of lease and equipment of Grandview Mining Co., Metaline Falls, Wash.

The Government's interest in the facilities constructed at Dumas, Tex., through Defense Plant Corp. during World War II were purchased in 1958.

**Plans for Expansion.** At the Monsanto, Ill., plant, facilities were installed for the production of die-cast and special zinc alloys. Capacity of this specialty plant is now 18,000 to 20,000 tons per year.

An improvement program at the Mascot, Tenn., mill will increase the annual capacity of the plant by 400,000 to 500,000 tons, or 30% above present capacity. Within three or four years, the plant is scheduled to have a capacity of 1.6-million tons of ore yielding 100,000 tons of 60% zinc concentrate annually.

Preliminary development of the Coy mine has been completed, and the mine has been in production since Jan. 1, 1959. The mine is now producing at 50% of its ultimate capacity. By the end of 1959 it is expected to be producing at 70% of capacity.

The Young mine, in Tennessee, is producing approximately 2,500 tons of ore daily; by 1961 the rate is scheduled to be 3,000 tpd; and ultimately 4,000 tpd, or 1-million tons of ore per year.

**Ore Reserves.** Mining on the original lease of the Grandview mine will probably be completed within a period of two years. On an adjoining property owned by American Zinc, the company has developed or indicated by drilling sufficient tonnage to continue maximum operation at present mill capacity of 230,000 to 250,000 tons per year for 25 years or longer.

In Tennessee, the company continues to expand ore reserves at the Young and Strawberry Plains property. Based on drilling plus 45 years operating experience in Tennessee, the company estimates that the properties now owned and/or under option will produce in excess of 100-million tons of ore yielding approximately 6-million tons of 60% zinc concentrates.

**Uranium Reduction Co.** American Zinc owns slightly less than 10% of the shares of the Uranium Reduction Co., in Utah, and has a management contract under which it assumes responsibility for the operations and finances of URC. In the fiscal year ending June 30, 1958, the URC mill was the largest producer of uranium concentrates in the U.S., and will probably be again in the fiscal year ending June 30, 1959. Although tonnage treated is lower than in the Anaconda mill in New Mexico, the grade of ore is substantially higher, thus accounting for the higher production of the URC mill.

Negotiations are being concluded with the AEC to extend a contract through Dec. 31, 1966. This contract will add five years to the guaranteed life of the mill and expand the total contract of the company since its inception to approximately $300-million. There is more than adequate ore in the area dedicated to the mill to assure an economic rate of production through 1966. Because of the relatively high-grade of the ore reserves of the Big Indian area as compared to those in other areas of the U.S., Canada and Africa, it is estimated that the combination of the Big Indian mines and the URC mill is one of the lowest cost uranium producers in the world today.

**Missouri Exploration Work.** In 1956 American Zinc joined with Granite City Steel Co., Granite City, Ill., in a program to prospect for iron and other minerals in Missouri. At present, 10,762 acres are under lease and option in Missouri, and diamond drilling is in progress in Bourbon and Boss-Bixby areas. Drilling results have been promising, but do not as yet warrant prediction of final results. At Bourbon the finding is entirely confined to iron ore. At Boss-Bixby several holes have exposed a good commercial thickness and grade of copper and iron. Drilling is all at depth of 2,000 to 3,000 ft.

## Selenium Supply-Demand Balance

THE SELENIUM industry in the U.S. showed a return to a balanced supply-demand pattern in 1958 after a decade first of scarcity and later of overproduction, according to the U.S. Bureau of Mines.

A sharp drop in production was responsible for reversing the trend and resulted in shipments exceeding production by a small margin during the year and producer stocks showing a sharp decline. The price quoted for selenium was stabilized after a decline in February. Imports were higher than 1957 and exports continued to be negligible. No new major developments in technology or consumption were reported.

Production of selenium decreased 32% from 1,077,000 lb in 1957 to 727,400 lb in 1958. Producers' shipments were 736,800 lb in 1958 as compared to 624,500 lb the previous year, an increase of 18%. Stocks at producers dropped 107,000 lb during the year to 551,000 lb at the end of the year.

Imports of selenium and selenium salts received from Canada, Japan, Sweden, and West Germany in 1958 totalled 183,680 lb. Canada totalled 149,629 lb, Japan 28,981 lb, Sweden 132 lb, and West Germany 4,938 lb, according to the Department of Commerce. This does not include imports of selenium contained in lead flue dusts imported from Mexico and Rhodesia-Nyasaland. The 1957 imports totalled 147,400 lb.

Companies reporting selenium production and shipments during the year were: Allied Chemical Corp., Marcus Hook, Pa.; American Metal Climax Inc.,

**In the U.S. continues on p. 104**

*now at your Allis-Chalmers dealer*

# the ONE FORTY FIVE— OUTSTANDING VALUE IN MEDIUM-POWER GRADERS

## 80 hp 21,540 lb

***...with features you can't match for the money on any grader***

**The new Allis-Chalmers ONE FORTY FIVE motor grader is built to outwork and outproduce any grader near its size...at a price you can't afford to overlook. An exclusive combination does it: high capacity front axle and throat clearance, big-grader power train, ROLL-AWAY moldboard, plus benefits that help an operator to do more work.**

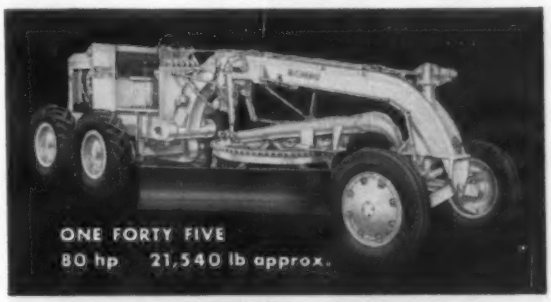
The ONE FORTY FIVE power train is built for long grading service. Simple, dry-type ceramic-lined clutch; constant-mesh transmission; heavy-duty gear train — all much stronger than you usually find in a grader this size.

Big clearance under the front axle straddles huge windrows without drag. Watch the ROLL-AWAY moldboard lift and roll the load. Check the load-clearing height from cutting edge to circle. You'll get more grading production than any other medium-sized machine can give you.

Now check these operator advantages. Platform is clean and roomy. Suspended pedals provide matchless foot room. Full visibility all around takes the strain out of operating. Toggle-type control levers allow ample road feel without wrist-snapping backlash.

Your Allis-Chalmers dealer will show you an eye-opening demonstration of the ONE FORTY FIVE. Then keep its low cost — and high performance — in mind when you're ready to buy. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ROLL-AWAY is an Allis-Chalmers trademark.




**move ahead with ALLIS-CHALMERS**
**...power for a growing world**

# NOW! REPUBLIC BRINGS YOU 3 MAJOR ADVANCEMENTS IN MINE ROOF BOLTING*

**HERE'S THE ASSEMBLED UNIT WITH REPUBLIC RS-1 EXPANSION SHELL**

**Advanced, all-purpose RS-1 has strong, flexible leaves for simple installation, and quick, efficient tightening. Narrow base support for the leaves assures easy, dependable expansion.**

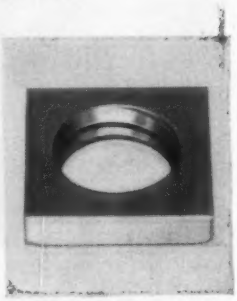
**Republic offers the largest combination of roof bolts, roof plates, and expansion shell assemblies available —for virtually any application, in any type of formation. Get details now.**

**MATERIAL CONTROL CERTIFICATE with every Republic Roof Bolt shipment gives specific physical properties of steel used. Data includes yield point in pounds per square inch, yield and break point in pounds, other information. Guesswork about performance is eliminated!**

## 1 PRECISION-TAPERED PLUG

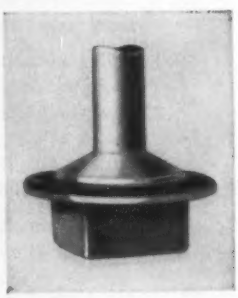
Engineered for proper shell expansion. Note angle of taper in illustration—the precise degree required for strength, dependability, and quick, efficient tightening. This improved Republic plug is versatile and adaptable, and is particularly effective in relatively soft formations.

## 2 HEAVY-DUTY SUPPORT NUT



Square nut provides over 40% better support than even the best previous method, yet maintains proper bolt tension by stripping at approximately 50 pounds torque with no damage to bolt threads . . . can be applied either side up to expedite assembly.

## 3 IMPROVED SELF-CENTERING HEAD



Compact, one-piece head eliminates need for second washer. Heavy flange, and thick, reinforced washer are guided cleanly and firmly into position in bolt plate. Entire unit forged, for ruggedness and strength. Standard 1⅛″ head available with ¼″ and ⅝″ bolt sizes.

CALL YOUR REPUBLIC REPRESENTATIVE OR MAIL COUPON FOR MORE INFORMATION

**All 3 advancements shown here as seen at the recent Coal Show*

**QUICK JOB-SITE ERECTION** is one important advantage of complete steel "Budget Buildings" by Republic's Truscon Division. Their simplified design makes this fast, on-site erection possible—no painting needed. They are also low in cost and re-usable. Truscon "Budget Buildings" are available in widths 12 to 28 feet . . . 10- and 12-foot heights; and in widths 32, 36, 40, 44, and 48 feet . . . 12- and 14-foot heights. Widths up to 80 feet with eave height of 14 feet are also available. Lengths as long as you want them. Send coupon for complete facts.

**THE STRENGTH OF STEEL PLUS THE CORROSION-RESISTANCE OF PLASTIC** are provided by Republic "Dekoron®-Coated" ELECTRUNITE® E.M.T. When properly installed, this versatile electrical raceway gives your circuits long-lasting protection against corrosive fumes, gases, and vapors. What's more, the extruded plastic armor of "Dekoron-Coated" ELECTRUNITE does not materially interfere with installation. Only ordinary tools are required. Joints are corrosion-protected by wrapping with pressure-sensitive plastic tape. Also available in rigid steel conduit. Send coupon for complete facts.

**EXCELLENT SERVICE IN HANDLING MINE WATER** is provided by Republic Flexible Plastic Pipe. Made of tough polyethylene, it is easy to handle in cramped quarters and conforms readily to irregular contours. Light weight and easy cutting and joining simplify installation. Relocation to meet changing conditions ceases to be a problem. Republic Flexible Plastic Pipe is impervious to the corrosive elements normally found in mine water, assuring years of trouble-free operation. Mail coupon for further information.

# REPUBLIC STEEL

*World's Widest Range of Standard Steels and Steel Products*

**REPUBLIC STEEL CORPORATION**
**DEPT. EJ-7944**
**1441 REPUBLIC BUILDING · CLEVELAND 1, OHIO**

Please send more information on:

☐ Mine Roof Bolts ☐ Truscon "Budget Buildings"
☐ FE Plastic Pipe ☐ Dekoron-Coated E.M.T.

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Hardinge Rod Mill awaiting shipment to the Marquette Iron Range to grind iron ore in a flotation plant.

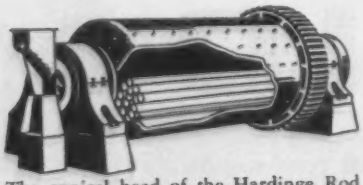
# Hardinge ROD MILLS

*Sizes* range from 2′ to 11½′ shell diameter and up to 1000 horsepower.

*Types* include trunnion overflow and peripheral discharge for both wet and dry grinding.

*Applications* include both open and closed circuit arrangements for ores, aggregates, concrete sand, cokes, and abrasives.

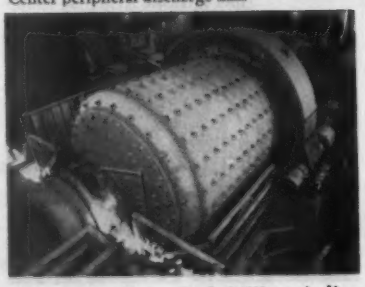
Complete specifications on request. Ask for Bulletin 25-C-1.



The conical head of the Hardinge Rod Mill provides a feed pocket to allow the charge to enter the rods without overloading or choking.

End peripheral discharge mill

Center peripheral discharge mill



Large Hardinge Rod Mill, grinding lead-zinc ore.

HARDINGE
COMPANY, INCORPORATED
YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works
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## Selenium *(Continued)*

Carteret, N. J.; American Smelting & Refining Co., Baltimore; International Smelting & Refining Co., Perth Amboy, N. J.; Kawecki Chemical Co., Boyertown, Pa.; and Kennecott Copper Corp., Garfield, Utah.

Production, shipments and imports of selenium in the United States in 1954-1958 in pounds of contained selenium:

| | Production | Shipments | Imports |
|---|---|---|---|
| 1954.... | 839,700 | 861,100 | 184,300 |
| 1955.... | 851,500 | 882,800 | 191,900 |
| 1956.... | 1,117,000 | 1,035,300 | 235,000 |
| 1957.... | 1,077,400 | 624,500 | 147,400 |
| 1958.... | 727,400 | 736,800 | 183,680 |

# IN THE U.S.

## ALASKA

**All land in the Hope district** south of the Turnagain Arm and north of Jerome Lake within about five miles east and west of Quartz Canyon and Sixmile Creeks has been designated by the U.S. Forest Service for the determination of surface rights on mining claims under Public Law 167 of July 23, 1955. This is in addition to many earlier areas within the Tongass and Chugach National Forests. Holders of claims staked prior to the date of the Act have 150 days from May 27, 1959 to file verified statements if they wish to retain exclusive surface rights to their claims.

**Alaskan Senators** have introduced a bill in Congress to help tin mining. It would provide for the purchase of lode tin at $1.40 per pound and placer tin at $1.25, and would set up delivery points.

**U.S. Smelting, Refining & Mining Co.** lost a dredge in its 40-ft deep dredge pond in Fairbanks Creek. It is conjectured that ice-blasting may have opened the hull.

**Alaska Juneau Gold Mining Co. reports unaudited first quarter 1959 earnings** of $335,973, as compared with first quarter of 1958 of $145,610. Figures do not allow for Federal income taxes because of the company's claimed tax loss.

**Robert Crowe-Swords, president, Northern Industrial Development Corporation Inc.,** announced in Vancouver that a big industrial development, including the construction of a smelter on the foreshore at Skagway, Alaska will proceed after a short delay necessitated through the admission of the territory to statehood. Contract for erecting foundations has been let to Puget Sound Dredging Co., Seattle. The company has wide powers granted by the state to engage in power development, lumbering and chemical manufacturing, but the principal objective will be the construction of a smelter to treat metallic ores from the northern territories.

*(Continued on p. 108)*

# ALEMITE® ACCUMATIC SYSTEM

**provides safe, accurate, instant lubrication . . . seals completely against abrasive dust!**

With the help of a modern Accumatic Centralized Lubrication System, this power shovel can be lubricated on the job, *between shovel loads*, at the touch of a button! No overtime or downtime is necessary for lubrication. No climbing to dangerously located bearings. A pre-determined amount of the proper lubricant reaches each bearing. *All* bearings are lubricated from one central point. Lubrication is safe and sure. The proper quantity of the correct lubricant is applied—without waste. Bearing life is prolonged.

**Type II Accumatic Measuring Valves,** used in this system, are fully hydraulic. Completely sealed for *clean* lubrication of power shovel. They handle all fluid oils and lighter greases up to a NLGI-2 rating. Available in four sizes—from .050 to .500 cubic inches.

***Write for Accumatic catalog today!***

Symbol of SW Excellence

ALEMITE DIVISION
STEWART-WARNER CORPORATION

**Dept. M-79, 1850 Diversey Parkway, Chicago 14, Illinois**

FALK and STEELFLEX are Registered Trademarks

## Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

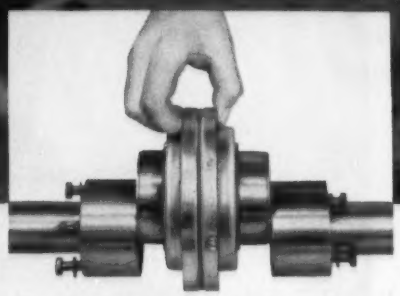
Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

To prove these claims and enjoy these savings, install a FALK Spacer on one application—and see for yourself. Consult your FALK Representative or Authorized Distributor.

**THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN**
*MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS*
**Representatives and Distributors in many principal cities.**

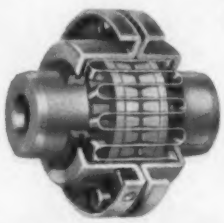


### EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



**The heart of the FALK Spacer ...the basic Type F Steelflex**
*Write for Service Manual 4838*

**FALK**
...a good name in industry

EIMCO

*design and production*

**PROGRESS REPORT**

B-406

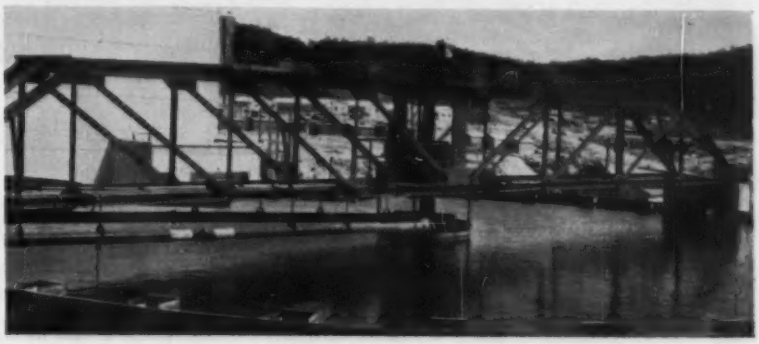
Process Engineers, Inc., Division of The Eimco Corporation: 420 Peninsular Ave., San Mateo, Calif.

## Operating Flexibility Provided By Eimco-Process Thickeners At Canadian Uranium Mill

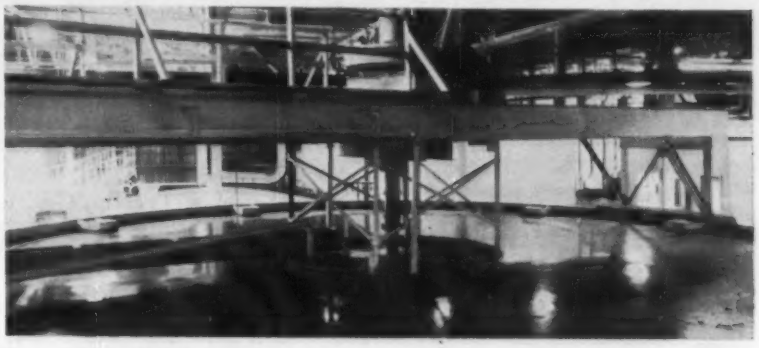
Lifting devices that can raise or lower the entire mechanisms as much as 12 inches while they are running are features of two 90 ft. dia. Type BX Eimco-Process thickeners at the mill of Milliken Lake Uranium Mines Limited, a member of the Rio Tinto group of uranium producing companies in the Algoma area of northern Ontario. These motorized devices provide operating flexibility in the washing circuit as they permit positive compensation for variations in the feed rate and ore characteristics or, if necessary, for the use of the thickeners as storage units during plant upsets.

Due to the corrosive nature of the leached pulp feed, each thickener mechanism is fabricated of Type 316 ELC stainless steel. A truss superstructure, resting on external concrete columns, supports the drive and raking assemblies. No hinged arms are used; when changes in the properties of the slurry tend to overload the mechanism, the complete raking assembly can be raised with the mechanism running, then gradually lowered as normal operation is resumed.

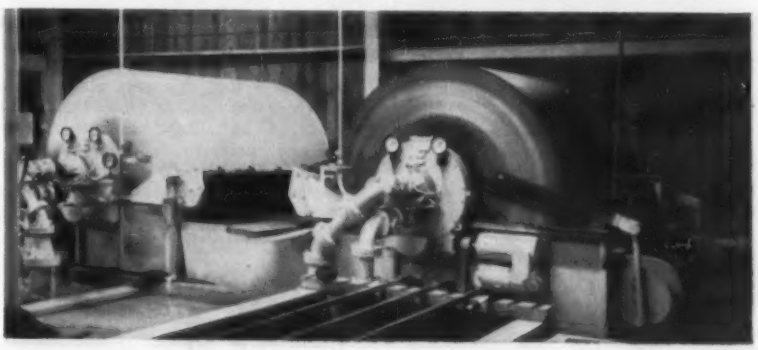
In the same mill, two 45 ft. dia. Eimco-Process beam supported units, also with stainless steel mechanisms, are being used to thicken the uranimum yellow cake slurry. Their underflow goes to one of the Eimco drum filter stations described below.



*90 ft. dia. Eimco-Process heavy-duty thickener with motorized lifting device*



*45 ft. dia. beam supported unit used to thicken uranium yellow cake slurry*



*Acid leached ore is filtered by these high-capacity continuous drum filters*

## Rio Tinto Mill Also Uses 28 Eimco Vacuum Filters

To handle the many filtration problems involved in converting low grade uranium ores into the basic fuel of the atomic age, this mill also has installed a total of 28 Eimco vacuum filters.

Filtration equipment installed here includes drums, discs, and Agidiscs. All are high capacity continuous filters, and are used for filtering acid leached ore, uranium precipitate and neutral pulps.

Eimco equipment was chosen after first-hand observation of the fine performance of other Eimco filters in the area. Engineers at the mill had considered all types of equipment, but decided that Eimco filters could provide lowest soluble uranium losses and freedom from operational difficulties for this application.

180 Eimco filters are now operating in the Algoma uranium producing area of Ontario. Many more are in operation in other uranium mining areas throughout the world.

Even "the toughest track ever made" (Allis-Chalmers, of course) needs adjustment to give you the extra life that's built into it. Make this on-the-job track check.

Take a pry bar and see how far you can raise the track above one of the support rollers. More than *two inches* means it's too loose. Take up the slack, move the tractor back and forth to equalize the tension, then check again.

Regular track inspection is an easy way to make sure you get the most out of "the toughest track ever made."

WHAT **toughest**
REALLY MEANS

It's more than just talk. Take sidebars, for instance. Some track makers get by with mere *surface* hardening, which sacrifices wearing quality for easier machining. But Allis-Chalmers *deep*-hardens the forged steel, leaving a tough inner core for high impact strength. Then, *pin and bushing bores only* are annealed, and the superhard sidebar is machined to precise finish dimensions.

The moral of the story: *Stay on the right track*—"the toughest track ever made." Get original-quality parts from your Allis-Chalmers dealer.

move ahead with AC
ALLIS-CHALMERS
power for a growing world

## ARIZONA

**Production of 20,000 additional tons of copper annually** will be effected upon completion of the new storage, transportation and milling facilities early next year at Ray Mines Div., Kenecott Copper Corp. In 1958, the division produced 49,932 tons of copper. New construction, already underway, is designed to increase the ore output of Ray mine and Hayden mill 50%, equalling the rated capacity of Kenecott's new smelter at Hayden, and constitutes the third phase of Kennecott's $40-million expansion program in Arizona. The new smelter was dedicated last November; plans to extend the perimeter of the mine were disclosed in April.

Stearns-Roger Mfg. Co. is handling all work on production facilities in the mill expansion program. The new phase includes: Construction of a 7,500-ton ore bin at Ray and construction of a 6,000-ton track hopper, and a 28,000-ton fine ore storage bin at Hayden.

Addition of five ore crushers, two grinding sections, six rows of flotation cells, two leaching drums, six washing classifiers and two complete rows of precipitating, conditioning and flotation cells for the leach-precipitation-flotation process are expected. Relocation of railroad tracks at Ray and construction of a new siding at Hayden are also included in the plan along with construction of new ore conveyor systems in Ray and Hayden, and purchase of 124 bottom-dump ore cars with load capacity increased from 65 tons to 100 tons per car.

**Western Gold & Uranium Corp.** has completed a 1,600-ft 2½-compartment shaft on the south rim of the Grand Canyon replacing the aerial tramway installed to haul out the ore.

Russel L. Richards, St. George, Utah, president of the firm, said the new shaft will allow the company to mine at 400 tpd, rather than present 200.

**Underground work at Miami Copper Co.'s Miami operation** would end about June 30, 1959. B. R. Coil, general manager, said that mineable reserves were nearly exhausted and that leaching in-place of the tailings and low-grade ore will be increased. The remaining 500 of the original 1,000 employees would be layed off when the mine closes. Copper Cities and Castle Dome open pits are not affected by the shutdown.

## CALIFORNIA

**Discovery of deposits of colemanite** is reported by Kern County Land Co. The company declines to elaborate on the find except to say that a major part of its "geologic field work and exploratory drilling has been carried out in the desert regions. This work has been directed primarily toward the exploration of calcium borates."

**American Smelting & Refining Co.** has announced that all San Francisco offices of its Selby lead smelter and refinery have been moved to the plant at Selby, California. The Selby telephone number is CRockett 923.

The move, which was made to more effectively coordinate plant and administrative operations, does not include Asarco's Western District Traffic Department, which will remain at 405 Montgomery Street, San Francisco.

**Sonoma Quicksilver Mines, Inc.'s production has turned upward** and May's output is expected to show a gain over the 219 flasks of mercury produced in April. Extensive underground improvement work, which had slowed normal production activity, has now commenced to be reflected in mining operations. S. R. Smith, president, said gradual improvement is expected until capacity output is reached about the end of August when its improvement program is expected to be concluded.

April quicksilver production brought the company's output for the first ten months of the company's fiscal year to 3,448 flasks vs 3,229 flasks produced in the like period of the preceding year. For the ten months ended April 30, 1959, the company treated 26,375 tons of ore and average recovery was 9.93 lb of mercury per ton. In the like period of the preceding fiscal year the company treated 24,959 tons and the recovery averaged 8.19 lb.

## COLORADO

**In the Gunnison district,** development at the Gold Links mine north of Ohio City indicates an excellent potential for it and other gold-silver properties in the Quartz Creek district, H. L. Bird of Boulder reports.

"We have been carrying on development work there on a conservative basis since May 1957," Bird explained, "and we have reached a point where substantial production may be expected in the near future."

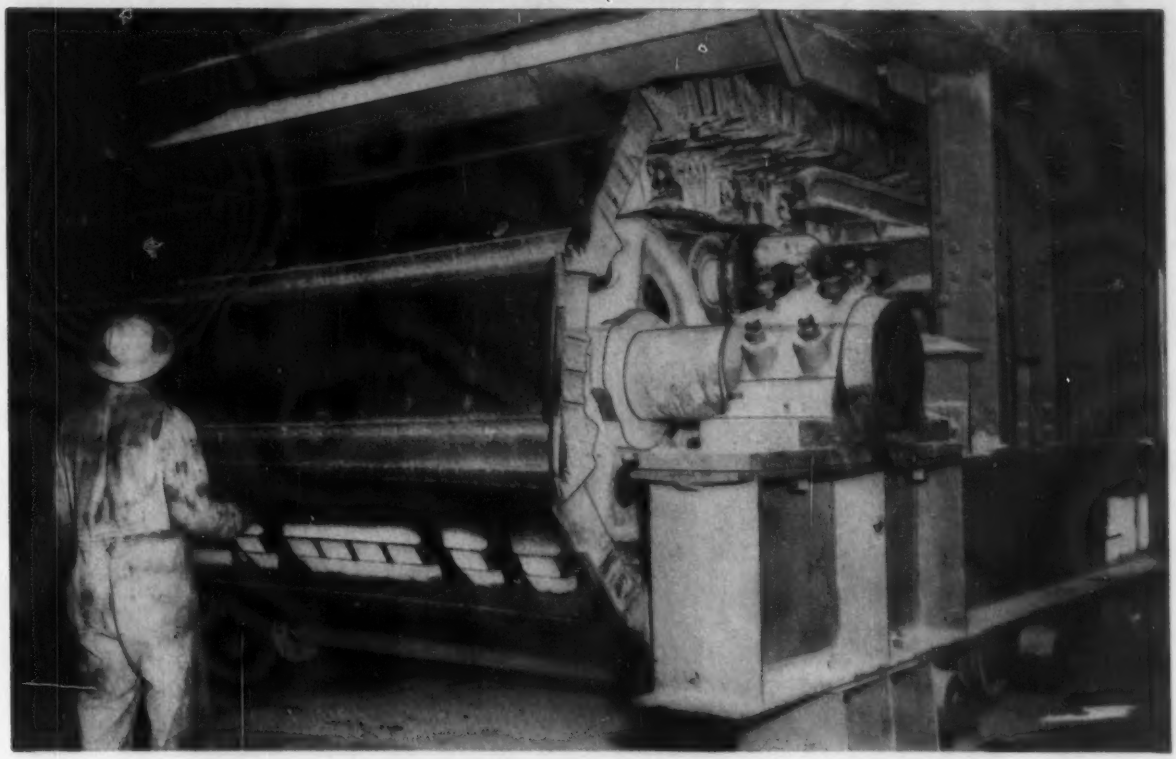
**Exploration by Fall River Exploration & Mining Co.** in the properties cut by the Lucania Tunnel shows assays running from one to three ounces in gold with other metals. Some of the values under the Russell Gulch area top these figures. Mining men see a revival soon on the properties located in the Nevadaville and Russell Gulch areas.

**San Juan County crews have completed** the clearing away of loose rock from the portal of the Gold King tunnel at Gladstone, and work of constructing the new portal and erecting the buildings has begun.

As soon as buildings can be erected, compressors and shop equipment will be installed in preparation of driving the big 9 by 9½-ft tunnel. The first work, after completion of the portal, will be slabbing the present tunnel to the breast, some 6,200 ft. Fifty-two pound rail will be used which is indicative of the magnitude of the operation. It will be sometime in July before actual slabbing operations will begin.

(*Continued on p. 112*)

# STEPHENS-ADAMSON



## ore handling systems increase tonnage...lower costs

Giant AMSCO Manganese Steel Pan Feeders handle the impact delivered by thousands of tons of run-of-mine ore and stone day after day . . . year after year. The experience of STEPHENS-ADAMSON engineers in the design and construction of Feeders, Apron Conveyors and complete Belt Conveyor systems is a result of 58 years of close contact with bulk handling problems throughout the world. From iron ore in Minnesota to diamond mines in Africa . . . from potash in New Mexico to nitrate and copper in Chile, S-A Engineering "know-how" has produced many of the world's most efficient and profitable conveying systems. S-A engineers with a world of "know-how" and a complete line of manufactured bulk materials handling equipment units are ready to answer your bulk materials handling problem.

A "48" wide primary belt carries a heavy load of 10 inch copper ore to processing at a Southwestern Copper mining installation. STEPHENS-ADAMSON engineered conveyor systems are designed to handle big tonnage dependably and at the lowest operating cost per ton of material handled.

WRITE FOR BULLETIN 255

S-A

MATERIALS HANDLING PRODUCTS

ENGINEERING DIVISION

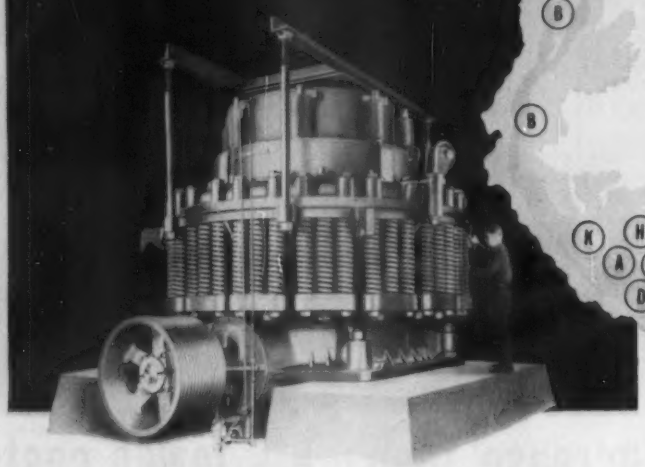
**STEPHENS-ADAMSON MFG. CO.**

GENERAL OFFICE & MAIN PLANT, 4 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

# SYMONS® CONE CRUSHERS

## play important role in processing ores and minerals in *South America*



*In all of the important ore and mineral operations around the world . . .* Symons Cone Crushers have consistently maintained a preferred position by efficiently processing large tonnages of finely crushed product at low cost.

In South America, scores of Symons Cones are used by leading producers of many of the country's ores and industrial minerals. Included in this group are the well known nitrates and copper ore of Chile . . . the tungsten, copper and vanadium of Peru . . . Bolivia's tin, second in world production . . . as well as the great mineral reserves of Brazil.

The use of Symons Cone Crushers in South America serves as another good example of the way these efficient reduction machines serve the mining and mineral processing industries of the world.

*NORDBERG MFG. CO., Milwaukee 1, Wisconsin*

**SYMONS CONE CRUSHERS**
*. . . The machines that revolutionized crushing practice . . .* are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.

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*SYMONS . . . a registered Nordberg trademark known throughout the world.*

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# Louisville Dryer—10 feet in diameter, 10 stories long!

Turn a ten story building on its side, and there'd be room to spare on either end of this huge pit lathe at Sharon, Pennsylvania where this 10′ x 110′ Louisville Dryer was fabricated.

This lathe is used for machining the reinforcing bands onto which are mounted the forged steel tires. This careful workmanship assures concentricity of the completed dryer shell—a primary factor in efficient seal operation.

Every Louisville Dryer is especially designed, manufactured, assembled and installed for its specific task.

If you have a problem involving process equipment, call or write our equipment specialist in your area. Here, as in so many fields, you'll find IT PAYS TO PLAN WITH GENERAL AMERICAN.

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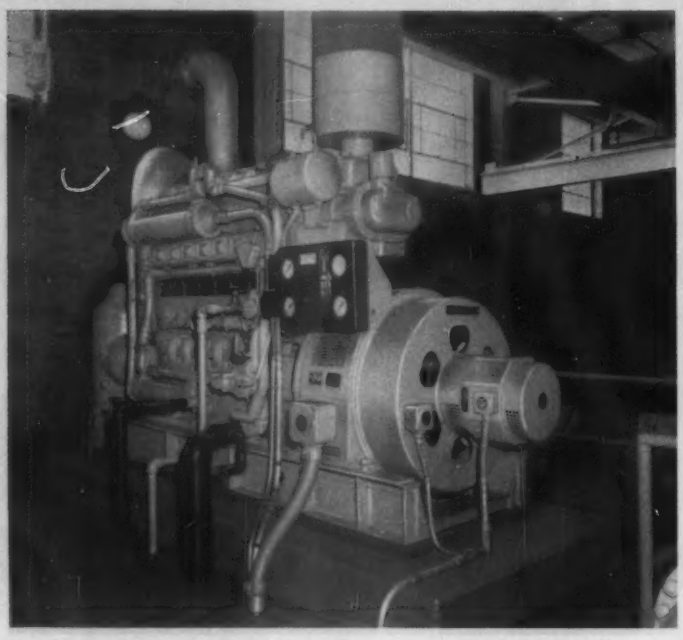
*Louisville Dryers*

# Picture of O-P economy!

Ohio pumping station saves $300 a month using **F-M** Opposed-Piston standby diesel for both power generation and pumping



Compact, lightweight Model 38F5¼ O-P is rated 450 hp. at 1200 rpm., direct drives a 175-kw. F-M alternator and, through right-angle gears, an F-M Pomona Vertical Turbine Pump with 5.5 mgd. capacity at discharge pressure of 105 psi.

Electric power off the flywheel end, high-service pumping off the front—that's the standby job cut out for this Model 38F5¼ Fairbanks-Morse O-P Diesel in the Elyria, Ohio water works serving 60,000 people.

Called into service for 3 to 6 hours a day in the Spring of 1958, the O-P pumped water for $1.50 less per million gallons than purchased power—a $300 per month reduction, including savings on demand charges. Each Saturday the engine makes a test run as the sole high-service on the line.

Versatile as well as economical, the Model 38F5¼ O-P is also ideal for direct-driving other equipment off the rear, with front end of shaft driving an auxiliary generator, crusher, pump, etc. The O-P can be furnished for either diesel, dual-fuel, or spark-ignited operation, and is available as a complete packaged unit with all accessories attached to the frame. Write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

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DIESEL, DUAL FUEL AND GAS ENGINES • LOCOMOTIVES • ELECTRIC MOTORS • GENERATORS
PUMPS • SCALES • COMPRESSORS • MAGNETOS • HOME WATER SYSTEMS


## Colorado *(Continued)*

Prescott Wood reports that about 25 miners will be employed in the Gold King Tunnel when the works get under way in Mid-July.

Recently a number of company officials, including assistant general manager Russ Wood, have flown in, using the local air strip.

**W. N. Monson of Denver Golden Oil & Uranium Co.** was in Silverton making plans for the company operation this summer in the Clear Lake area. Last year, Denver-Golden, prospecting and doing exploration work, opened up a number of gold-bearing quartz veins. Samples displayed in Silverton showed considerable gold, but apparently no base metal.

**Richard Peterson of Douglas, Wyo. and Bruce Anderson of Denver** have been active in the Cripple Creek gold district since last fall operating as the Western Engineering Corp. The company has leased the Grace Greenwood mine in addition to taking a lease on an Ajax block of ground. They have been working the property since last fall.

Warren Ove, mine manager for the company will move here from California. Peterson and Anderson announced they would discontinue using the name of Western Engineering Corp. in their mining activities and in the future would operate as Anderson & Peterson.

**Silverton looks forward to the most active year in mining in a quarter-century.** Shenandoah Ltd. is already working—a small local crew is rehabilitating the Shenandoah mine. The portal at Gladstone will be under construction shortly. The continuation of the famous Gold King Tunnel will get under way in midsummer, and will be driven under the Sunnyside mine, after which, through a series of raises, mining will begin. Ore from these mines will be treated at the big Shenandoah mill east of Silverton. The company does not plan to start the mill until late in the fall.

**The Continental Chief mine at Leadville,** has been purchased by Benson Mining & Leasing, Tucson, Arizona, according to Robert R. Benson. Mine is said to have been a one-time high-grade silver producer but has not been operated since 1918. Benson plans to do some exploration work in addition to mining some proven orebodies.

## IDAHO

**J. C. Kieffer, manager of the northwestern mining department of the American Smelting & Refining Co.,** reports that sinking of the main shaft of the company's Galena mine near Wallace is continuing, but that progress has been slowed due to cutting the 4000-level station and installing bearer sets. The shaft bottom is 24 ft below the 4000 level, Kieffer said. He also reports that drifting

(*Continued on p. 118*)

PROFIT NEWS FOR POWER USERS IN THE

# all purpose power line

(20 TO 1650 H.P. IN ONLY 3 CYLINDER SIZES)

**Now you can enjoy all the benefits of GM Diesel standardization in every type of equipment and still buy the best make of equipment on the market**

GM Diesel engines are offered in more than 1800 applications of power equipment built by over 250 leading manufacturers—wider availability than any other Diesel

Only if a power user standardizes on GM Diesel will he get *all* the benefits of engine standardization—for *only* GM Diesel covers the entire power spectrum with only 3 cylinder sizes

Widest parts interchangeability pays off for fleet users in lower parts inventory requirements —for example, many parts for a 33 H.P. "Jimmy" Diesel fit a 1650 H.P. "Jimmy"

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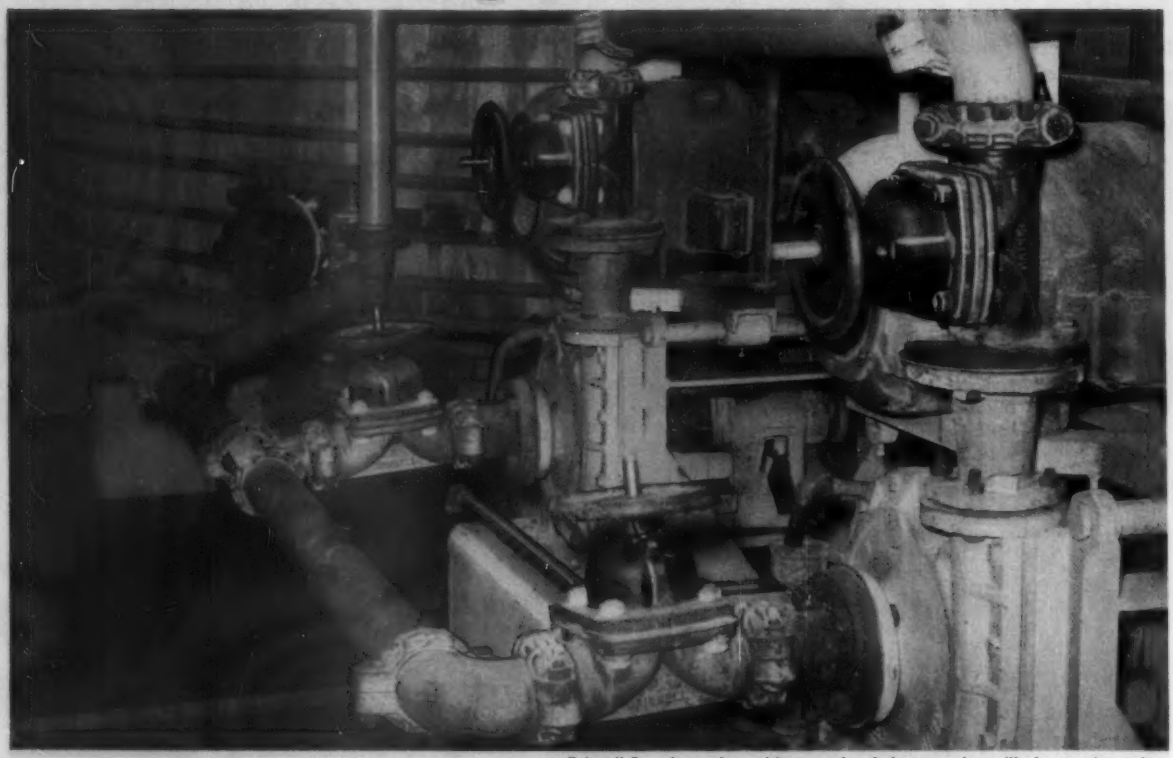
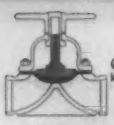
# For fast, tight, dependable connections... Grinnell-Saunders Diaphragm Valves with grooved ends



Grinnell-Saunders valves with grooved ends in processing mill of a uranium mine.



Standard weir-type Grinnell valves, or the Straightway *(for straight-through flow)* enjoy wide usage on lines handling fibrous slurries, solids in suspension, sludges, semi-fluid materials, chemicals, water and gas.

Grinnell-Saunders Diaphragm Valves with grooved end connections permit flexibility in handling pipe misalignment, vibration and settlement. They also offer longitudinal tolerance which automatically compensates for contraction and expansion, and absorbs pipe length inaccuracies.

Grinnell-Saunders valves rate high in design features, too. They provide streamline flow in either direction, positive closure even when handling gritty or fibrous materials; complete isolation of bonnet mechanism; low cost maintenance — plus interchangeability of parts. Bodies are available in many different materials, including rugged ductile iron. In addition, linings and diaphragms may be had in a choice of materials to meet different conditions. Write for details.

**Grinnell Company, Providence 1, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors**

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
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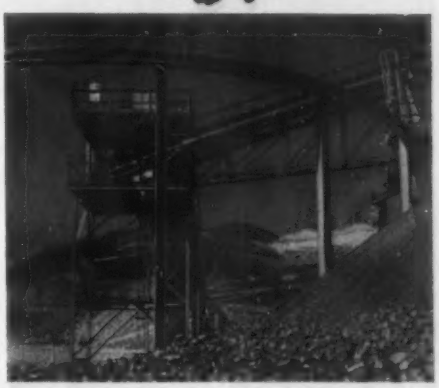
Design of a concentrating plant to process 60,000 tons of iron ore per day. Open pit bauxite facilities. Coking coal processing plants. Diatomite plants. Cement plants. These are a few of many projects and studies Kaiser Engineers undertakes for the Minerals industries in the United States and world-wide—Quebec, Jamaica, Mexico, Brazil, Australia, New Zealand, Greece, Turkey, India.

From determination of process through design and construction of complete facilities, KE can perform any or all steps. And perform them with Ingenuity—to produce a more efficient operation, in less time, at lower cost.

For your next facility—whether ferrous, non-ferrous or non-metallic—call KE.



Pendulum ore conveyor—Ingenuity produced KE innovation distributing beneficiated iron ore in 180° crescent: conserved space, cut rehandling costs.

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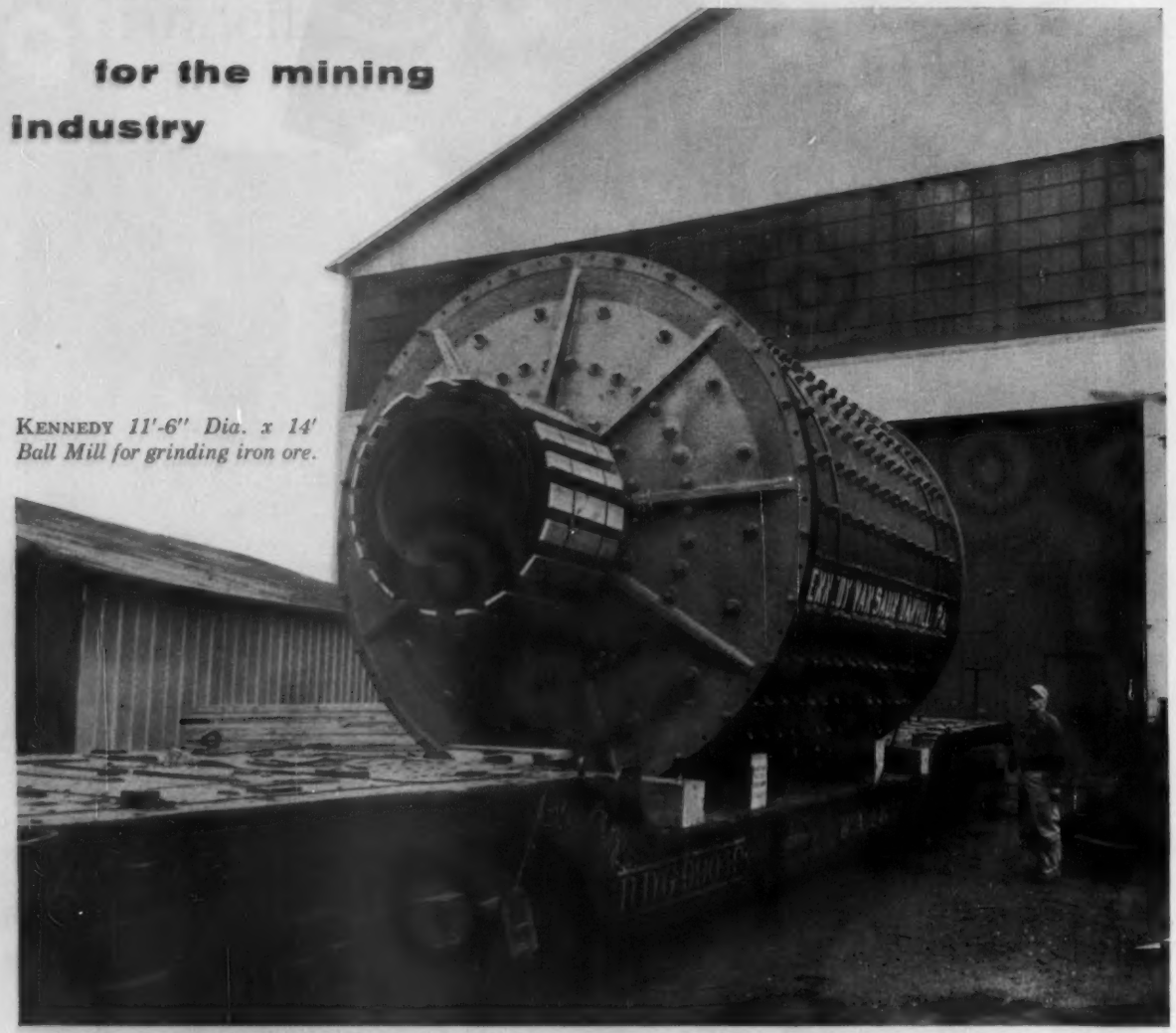
# KENNEDY BALL MILLS

## for the mining industry



KENNEDY *11'-6" Dia. x 14' Ball Mill for grinding iron ore.*

Dependable operation in wet or dry grinding of material at low cost, with minimum maintenance—this is the reputation that KENNEDY Ball Mills enjoy.

You can profit from this reputation by specifying KENNEDY.

*Send for complete information on* KENNEDY *equipment.*

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- Cast steel or Meehanite heads
- Welded and stress-relieved heavy steel plate shells
- Large diameter trunnions
- Self-aligning bearings with adjustable sole plates
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- Motorized hydraulic lift to reduce starting torque
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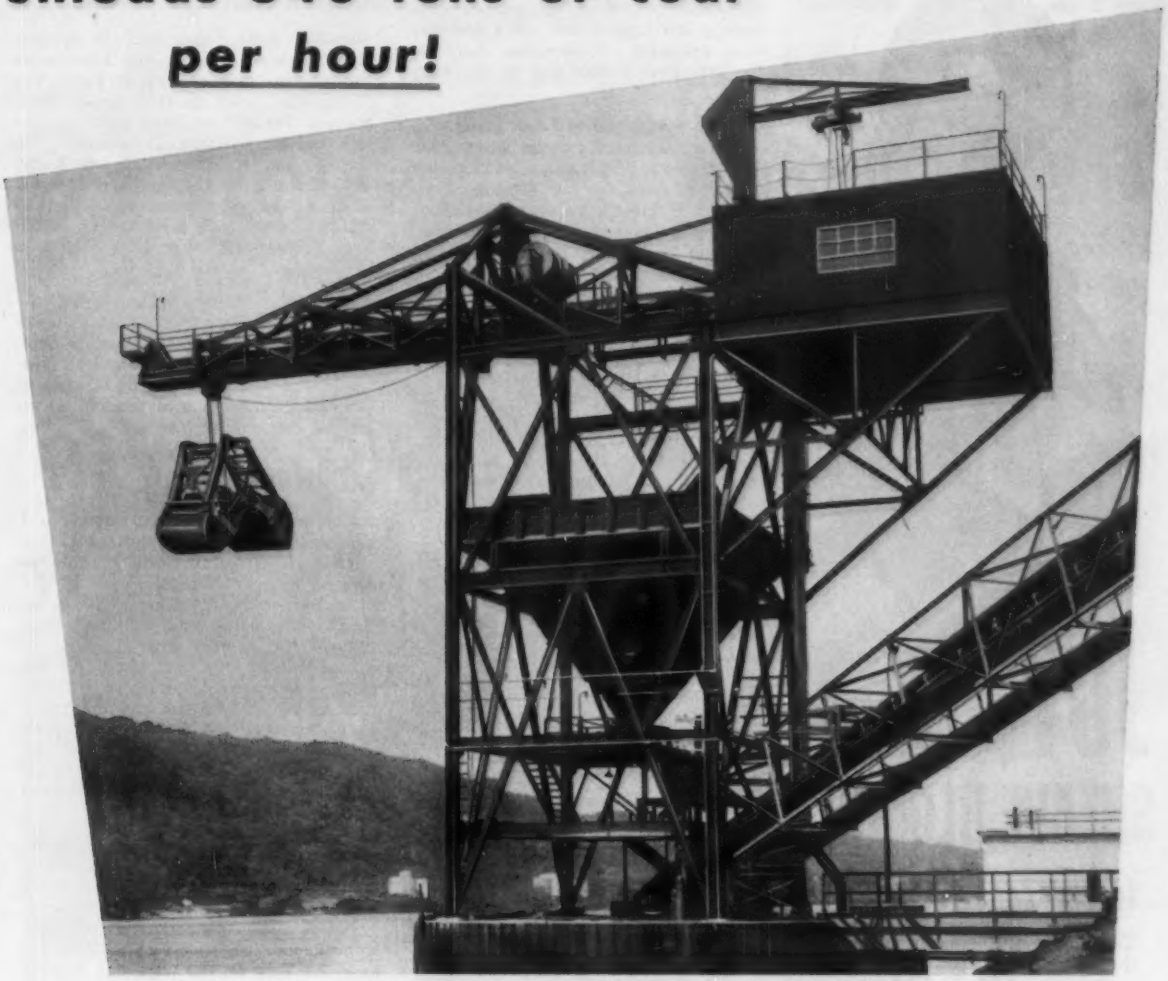
# BROWNHOIST TOWER

## *unloads 540 tons of coal per hour!*



Designed and built to unload coal from barges to a power plant on the Ohio River, this Industrial Brownhoist stationary tower crane achieves a production rate of 540 tons per hour! Barge hauls move barges to proper location underneath unloader and coal is transferred to 100 ton bin built into the tower and then fed on to a belt conveyor to the plant. All motions are controlled by operator from one position in operator's house which is pressurized with clean air provided by a blower.

The tower, with a 6-ton rope system, is fixed to a concrete cell and is of all-welded construction. Erection joints are fastened with high strength bolts. A pillar crane is fixed to the tower to service electrical and machinery parts in the machinery house.

Industrial Brownhoist designs and builds specialized equipment like this tower in any tonnage and capacity for handling any material at sea ports, steel mills, ore and coal docks and railroad yards throughout the world. For more information on reliable high speed, high capacity material handling equipment, write for catalog 562.

209

# BROWNHOIST

CLAMSHELL BUCKET

250 TON WRECKING CRANE

COAL-ORE BRIDGE

CAR DUMPER

LOCOMOTIVE CRANE

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JOY quick opening
SHEAVE BLOCKS

forged construction

The hook and side plates of the 6″, 8″ and 10″ sizes are *forged alloy steel*. The wheel is chrome-nickel-moly cast steel. All parts are heat-treated for strength and wear resistance.

simple & rugged

There are no pins, chains, bolts or nuts to handle or remove. TO OPEN JUST TURN AND PUSH . . . no parts leave the block to become lost. The rugged opening mechanism will last for the life of the block.

Write for Bulletin 287-4

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

## Idaho *(Continued)*

out on the Silver vein on the 3700 level is continuing with satisfactory results. The company's Page mine west of Kellogg has been placed on a four-day week operation. Crosscutting there on the 3400 level is half way to the Tony vein.

**Lucky Friday Silver-Lead Mines Co.** is gearing operations at its silver mine near Mullan to preparations for increased production when the new 400-ton capacity mill is placed in operation about year-end, William H. Love, general manager, and H. E. Harper, chief geologist, told stockholders at the company's annual meeting. Principal development in the mine is on the 2600 and 3050 level east drifts, they said. Four of the company's directors—L. J. Randall, H. F. Magnuson, George W. Zeller and Love, all of Wallace, were re-elected and John E. D. Grunow, an attorney of Newmont Mining Corp., New York City, was named to the board. D. W. Morehouse, Wallace, was appointed secretary-treasurer to succeed W. J. Emacio, resigned.

## MAINE

**More than 50 geologists** from universities, the U. S. Geological Survey, and the Maine Geological Survey will take to the field and air this summer to study and map almost four and one-half million acres in Maine, in scattered areas ranging from the New Hampshire border to Cutler in Washington County, and from Kittery to northern Aroostook.

In addition, John R. Rand, director, Geological Survey, DED, anticipates as many as two dozen technical representatives of private mining and exploration companies may be working on problems directly related to finding or evaluating commercial deposits of metals and industrial minerals in Maine.

As an aid to working out the geology and commercial potential of forested or inaccessible areas, both the USGS and the Maine Geological Survey will use airplanes equipped with special equipment to survey large areas quickly and to gather geophysical information.

Most of the projects planned by the public agencies and universities, however, involve slow, careful examination and mapping of bedrock or glacial features for the purpose of compiling all available evidence of rock and glacial types. The wealth of soil and forest cover masking geologic features makes it necessary for this work to be done on foot with two to three years usually required to complete such projects.

## MICHIGAN

**Pickands, Mather & Co. now has but one operating mine** on the Menominee range: the Buck at Caspian. The Buck was closed on July 24, 1958 and shipped 182,684 tons that year. It was reopened in April 1959 on a trial basis with all miners working on a straight company account rate, no contract miners, and the men agreeing to maintain production at the rate that prevailed when the mine was closed.

**Republic Steel Corp.**, too, is shipping from a single mine on the Menominee range, the Tobin at Crystal Falls. The Tobin was closed on October 16, 1957, shipped 144,085 tons that year and was idle, but for pumping and maintenance, through 1958. Repair work was begun on March 9, 1959. Republic leased the adjoining Genesee mine in May 1955 and will mine and hoist its 1.5-millon tons through the Tobin shaft after driving a 3,000-ft drift.

**North Range Mining Co.** closed the Warner at Amasa on May 1, 1958; made the closing a permanent one on Sept. 27, 1958; and dropped the lease in November of that year. The Book mine at Alpha is still being held pending an increased demand for iron ore.

## MINNESOTA

**Inland Steel Co. closed its Armour No. 1 underground mine at Crosby on June 9th., perhaps permanently.** The lease expired on June 10th. The crew of 130 men reported at the Armour No. 2 underground mine on June 10th, so lost no time. Both mines were opened by Rogers-Brown Ore Co. in 1912 and were taken over by Inland Steel in 1915. The Armour No. 1 is nearly exhausted after having shipped about 7-million tons: about 300,000 tons remaining. The Armour No. 2 still contains an estimated 3-million tons of ore and has shipped approximately 6.5-million tons.

**Rhude & Fryberger are shipping from their Troy mine** near Eveleth which they have operated since 1947 with total shipments of about 2-million tons. This season, the company is also mining from the Pearsall Reserve pit, which adjoins the Troy on the west, and hauling the ore to the Troy mine plant for treatment.

**Stripping at the Huntington Extension mine of the M. A. Hanna Co.** was carried on during the past winter and ore will be shipped this season. The Huntington, Huntington Extension, Feigh and South Hillcrest on the Cuyuna range now form one large pit. Also, during the winter a fines-loading pocket was completed at the Maroco mine plant, Cuyuna Range, which will receive the product from the plant's cyclone section, minus ¼ in., while the original pocket handles the heavy media product, plus ¼ in.

**Stripping at the M. A. Hanna Co.'s Robert mine on the Cuyuna Range** which began in 1957, was discontinued, resumed in 1958 and was carried on during the winter of 1958-'59. As of Jan. 1, 1959, nearly 3.5-million cubic yd. had been moved. Stripping will be continued for three years and a total of about 4,630,000 cubic yd. will have been removed.

*(Continued on p. 120)*

# Built tough

## for round-the-clock service in grueling applications

Pre-Bilt conveyors are available in belt widths of 18, 24, 30 and 36 inches. Truss and channel structural frames are designed to AISE standards for spans up to 50 ft. Supporting bents, chutes and other accessories are standardized.

### All these advantages from selection to erection with pre-engineered units

**EASY SELECTION** from standardized Link-Belt components. Your Link-Belt sales engineer will help you select the right combination.

**ON-THE-SITE QUOTATIONS** by a trained sales engineer. He will prepare a prompt quotation on all components necessary for efficient operation.

**LOW FIRST COST.** Pre-engineered, shop-assembled components, prompt delivery, fast erection time—all result in lower initial costs.

**LOW OPERATING COSTS.** Due to rugged design, maintenance normally consists only of lubrication. More economical based on cost per ton handled.

**QUICK DELIVERY.** Pre-Bilt sectional belt conveyors are manufactured and shipped from one of nine plants located nearest your operations.

**FAST, LOW-COST INSTALLATION.** Simple construction facilitates field assembly, reducing time and costs of erection.

### LINK-BELT Pre-Bilt belt conveyors bring savings from the start

Speed, economical operation and dependability—conveying features required in every industry—are provided by Pre-Bilt Sectional Belt Conveyors. They stand up in the most rugged, full-time operations. And normally the only maintenance required is lubrication.

The same engineering design which has produced some of the world's outstanding conveyor systems is applied to Pre-Bilts. Standardized, shop-assembled components are selected to specifically fit your installation. Simple construction provides ease of handling and erection.

No other conveyor offers such rugged design and economy of operation in bulk materials handling. Call your nearby Link-Belt office for complete information. *Or write for Catalog 2779*, a new "Idea Book" for cutting costs with Link-Belt Pre-Bilt sectional belt conveyors.

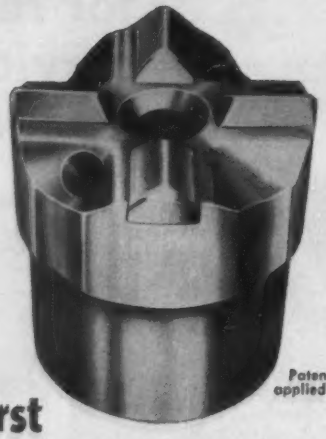
LINK-BELT

BELT CONVEYOR EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Australia, Marrickville (Sydney); Brazil, Sao Paulo; Canada, Scarboro (Toronto 13); South Africa, Springs. Representatives Throughout the World. 19,193

# LIDDICOAT

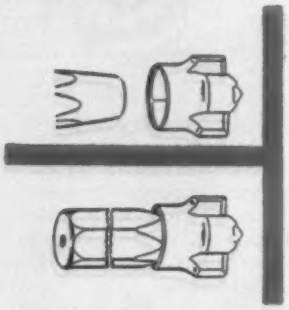
## the tungsten carbide bit that needs no resharpening



Patents applied for

## Fast drilling—long life—low first cost—low cost per foot of hole drilled

The exclusive, shallow, long-life inserts need no resharpening because they do not develop a reverse taper dullness . . . a condition that stops drilling in the conventional multi-use bit. The exclusive design of LIDDICOAT permits fast drilling far beyond the point where conventional multi-use carbide bits must be withdrawn from service for resharpening. Fast drilling continues during the entire bit usage without need of resharpening.



### Taper socket — No threads — Fast, firm attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new, short-taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.

## Forged for toughness from nickle alloy steel

Bodies for Liddicoat bits are produced by forging. By a patented manufacturing process, the alloy steel is subjected to tremendous pressure which extrudes it into the desired shape. This method preserves the important grain of the steel, flow lines being compressed rather than cut across as is usual in forgings of this type. The retention of the unbroken grain and the compression of the material gives Liddicoat bits an unusually strong structure.

**WESTERN**
*Rock Bit Manufacturing Company*
552 West 7th South Salt Lake City 1, Utah


## MONTANA

**Anaconda Co. does not expect any sizable change in its mining program at Butte in the next year or so, Clyde E. Weed, chairman of the board of directors said in Butte June 9.**

"We expect that our mining operations will go along pretty much as at present," he said. "However, we do not contemplate the expenditure of a considerable sum for capital improvements in Montana and we anticipate that Anaconda will continue to make a substantial contribution to the economy of the state during the forseeable future."

Mr. Weed said that last year the company's cash disbursements for operations in Montana totaled approximately $130-million. "We believe that our work here will continue to require these large outlays," he said.

## NEVADA

**Nevada Mines Div., Kennecott Copper Corp.,** has placed the $1-million plus skip hoisting system into operation in the Liberty pit. Inclined hoist, with 1,000-tph capacity, will work on a three-shift basis to haul out 21,000 tpd, and replace truck out-haulage from the pit which has now reached a depth of 700 ft. Nevada Mines also plans to build a $300,000 accounting office at McGill in White Pine County.

**U.S. Government is the sole owner** of claims and property of Copper Canyon Mining Co. (bankrupt) on Battle Mountain, having purchased them for about $100,000 at a recent auction.

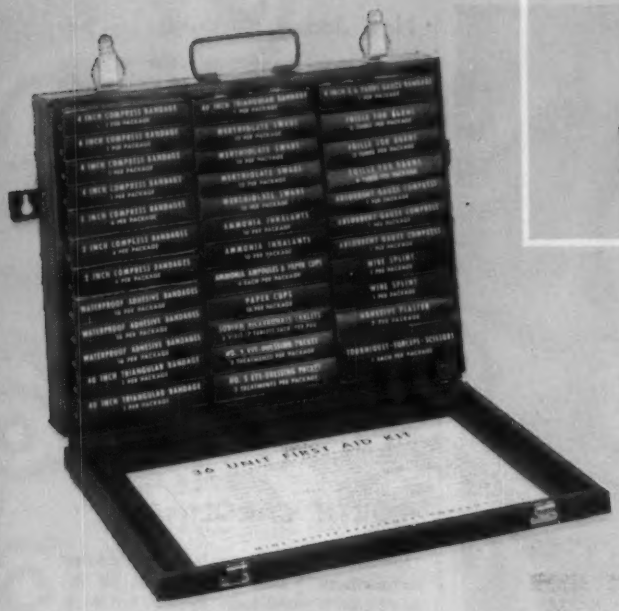
**Big Divide Mining Co. completed another 150 ft of tunnel in the Tonopah Divide mine in May,** driving through a highly mineralized rock with good gold values. A depth of 850 ft has been reached. In Elko County, **Reed & Sons,** leasers and operators of the Bootstrap mine, report a 60-ft gold vein discovery averaging $18/ton for the entire width. Property lies 24 miles north of Dunphy and produced 20,025 tons of ore in 1958 which after cyanidation returned a gross income of $129,823. Also in Elko, the lease of the Charleston Hill mine to the **Ran Rex Mining Co.** has been approved by the court. Also approved was the sale of a selected lot of mining machinery belonging to the mine owner, Charleston Hill National Mines Co. which is in receivership.

## NEW JERSEY

**Maywood Chemical Works** is being acquired by Stepan Chemical Co. (Chicago). Stepan president Alfred Stepan, Jr., says his company is buying Maywood as part of its program to win new markets and new customers. So far, Stepan has picked up more than 80% of Maywood stock and has offered to buy the remainder. Total price will be about $5-million, and will not, Stepan adds, require equity financing.

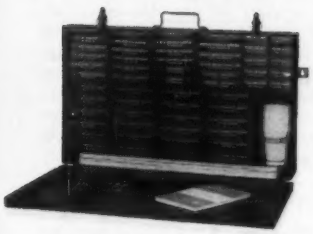
Maywood president Albert Turner ex-

*(Continued on p. 122)*



# M-S-A® Type D ALL-WEATHER FIRST AID KITS

When emergencies call for first aid, these kits provide all the advantages for quick, complete treatment. Unit packages, easily replaced, are arranged for fast selection, contain one or more complete dressings or treatments for each injury. All dressings are sterilized and ready for use. Cellophane package wrappings protect contents. The kits, available in 10, 16, 24, and 36 units, are made of 20-gauge steel, with carrying handle, and mounting brackets. Case is dust and moisture-proof. Ideal for carrying on jeeps, motors or other mechanized equipment. Complete instructions with each kit. Write for details.

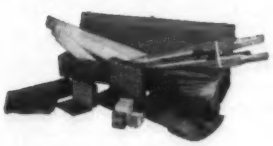


## M-S-A MINER'S FIRST AID CABINET

Contains complete assortment of first aid material and supplies. Ideal for mine hospital or dressing stations. Contents conform to U. S. Bureau of Mines recommendations.

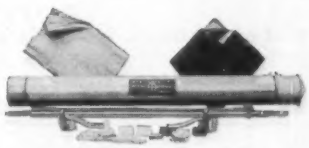
## M-S-A FOILLE BURN KIT

Contains four 10-ounce Foille Aerosol Sprays, easy-to-use Type D first aid dressings and accessories. Stored in All-Weather steel case. Permits fast effective burn treatment.



## M-S-A EMERGENCY FIRST AID OUTFIT

Ideal for storage underground where a compact unit is needed. Contents selected to meet practically every emergency. Includes two first aid kits, blankets, splints, Redi-Heat Blocks, stretchers. Sturdy steel case.



## M-S-A STANDARD STRETCHER OUTFIT

Complete assortment of first aid dressings and supplies arranged in a strong dust-proof canister. Contains stretcher, blankets, first aid materials, splints. Designed for first aid rooms, dressing stations.

# MSA . . . headquarters for First Aid Equipment

Above are a few of the many first aid supplies and treatments available from M-S-A. This material is the result of years of experience in serving the mining industries' requirements.

Our knowledge of emergency needs has developed the design and contents of our first aid line.

You will find complete information in our Mining Catalog·····30 pages are devoted to illustrations and detailed information on these and many other first aid supplies. We will be happy to send you a copy upon request.

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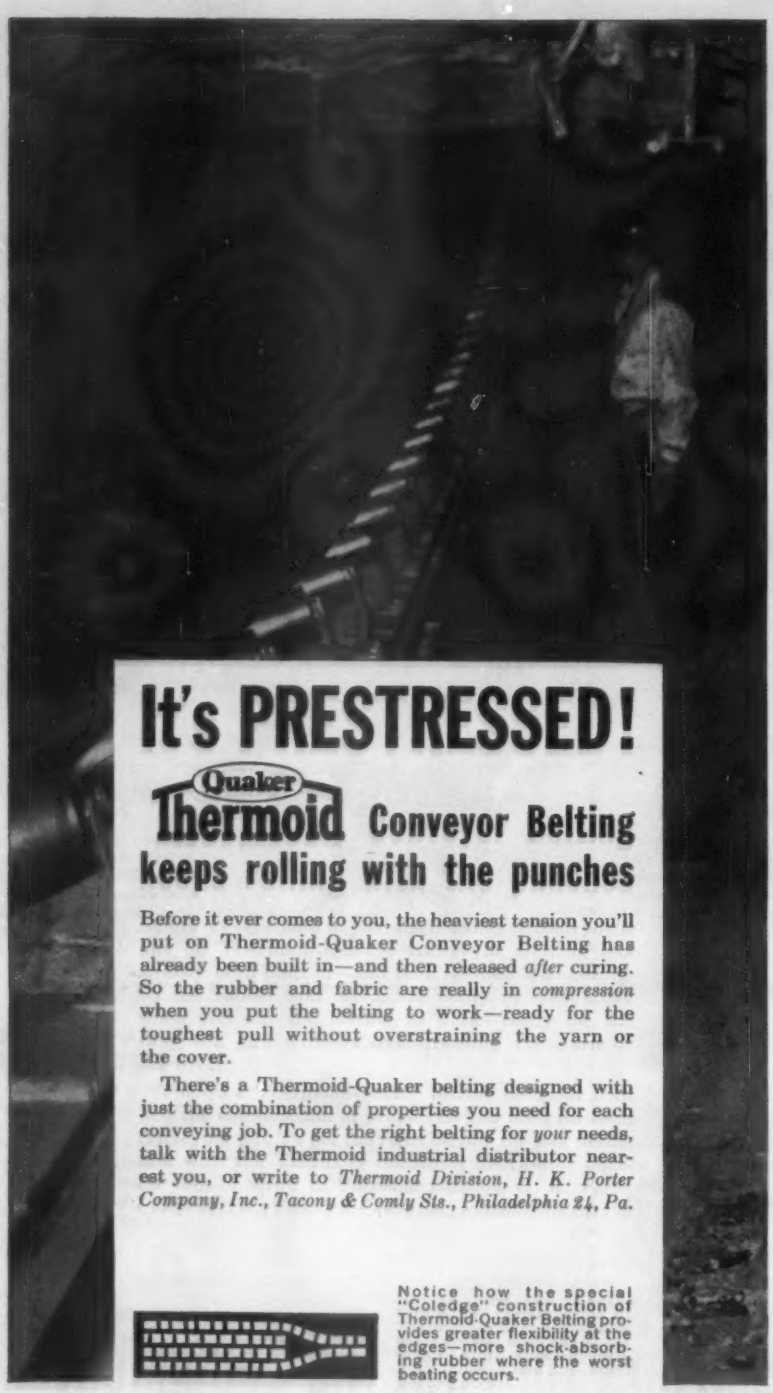
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## New Jersey *(Continued)*

plains that the Stepan offer is being accepted because some of Maywood's senior stockholders find it a convenient opportunity to cash in their holdings.

## NEW MEXICO

**Phillips Petroleum Co.** has purchased for an undisclosed price three mines in the Ambrosia Lake district developed by the exploration staff of Food Machinery & Chemical Corp., Pocatello, Ida. Phillips is reported to have purchased the properties to make up deficits in shipment of ore to its new mill now onstream near Grants. Properties bought included the Faith and Doris mines and the Doris extension. They are small operations.

## NORTH CAROLINA

**Operations at the Tungsten Corp.'s mine in northern Vance County** will be resumed on a small scale in July, although actual mining of the ore will not be started again in the near future, it was stated June 10 by W. R. Atkins, manager of the company's operations.

Atkins said that prospects now are for continued activity of the character involved for probably a year, providing jobs for 30 or more persons, but he made it clear that mining of tungsten itself is not being revived at this time. However, some 26,000 tons of by-product ore taken previously and which has accumulated will be worked and shipped to a smelter at Leadville, Colo. for its silver, lead and copper content.

**Lithium Corp. of America's plant at Bessemer City** will continue operations in 1960 but at a reduced rate. This year it will be shut down the entire month of July, instead of the normal two weeks, it has been disclosed by company officials.

The situation is due to a halt in Government purchases—practically the entire output of the plant has gone to the Atomic Energy Commission since operations began four years ago. The Government contract expires December 31.

## PENNSYLVANIA

**Foote Mineral Co.,** possibly spurred on by an impending steel strike, had the best first quarter in the company's history due to heavy electrolytic manganese sales. At the annual stockholders' meeting, Foote officials announced that the loss of the AEC lithium hydroxide contracts will not seriously affect 1959 earning because Foote is a diversified company; plans to expand and improve the electrolytic manganese process; new products being developed in Foote's R&D lab may have sales potential that will dwarf some present lithium markets; the company will decide by 1960 or 1961 whether to get into the silicon market in a big way or get out entirely.

**In Canada starts on p. 124**

## Communist China

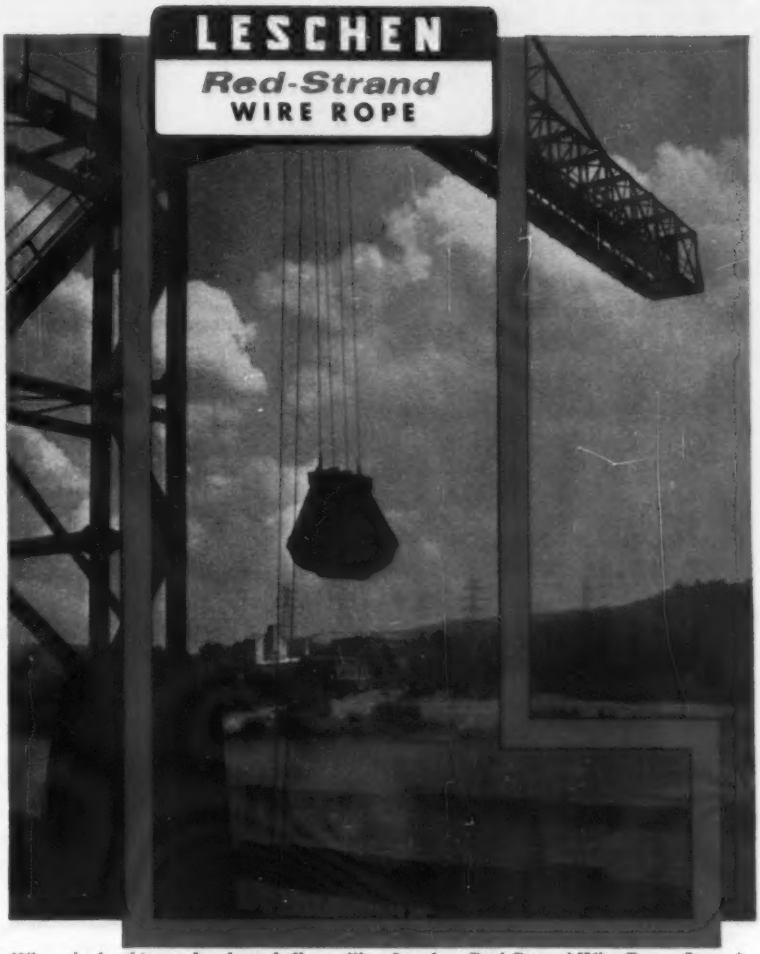
*(Continued from p. 77)*

**Miscellaneous plants** — The Chinese Communists have begun construction of small-scale aluminum plants in various parts of the country. They contend that the plants are workable and enough of them can together furnish an important part of the primary aluminum supply in the future. Some information is available on one such plant in Peiping. It is said to be a 1,000-ton per year aluminum (with corresponding alumina) plant, using combination modern-native methods, which was completed Sept. 19, 1958, after 40 days of construction. Coal ash and clay are the raw materials. As much brick as possible was substituted for steel in furance construction. Power capacity required is 2,000 to 3,000 kw. Apparently the reduction part of the Peiping plant is along modern lines. A 1,000-ton per year aluminum plant in Tsamkong, Kwangtung Province, is reportedly scheduled to commence operations in mid-1959; this plant presumably makes alumina from clay, slag, or kaolin. The Chinese Communists also say that a small but modern aluminum-alumina plant ("several thousand tons of electrolytic aluminum") has been in the process of construction in Mutanchiang, Heilungkiang Province, since June 1958. A 100-ton per year aluminum plant was reportedly programmed for Shanghai in mid-1958.

Information on various large and small aluminum plants in Communist China is generally so fragmentary that a realistic evaluation is not always possible. One of the enigmas of the aluminum facilities in Communist China is the Antung aluminum-alumina plant in Liaoning Province, Manchuria, which the Japanese claim to have practically completed by the end of World War II and which the Chinese Communists have never mentioned. The plant was scheduled to have annual capacities of about 10,000 tons of aluminum and 20,000 tons of alumina; the alumina plant was designed for the soda-lime-sinter process using Shantung ores. It is suspected that the USSR removed the key equipment in 1945 and subsequently returned same to Communist China, which installed the reduction equipment at Fushun and the alumina equipment at Nanting.

**E&MJ's coverage of Canadian News developments begins on the next page.**


# when the going gets rough-
# give 'em "L"

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## TENNESSEE

**New Jersey Zinc Co.** is rapidly getting their zinc mine at Treadway in full production. This mine, located on a large ore body outside the Mascot-Jefferson City district, was completely developed in 1958 while the zinc market was in the doldrums of a price slump. When the zinc price structure improved in the early part of 1959, the mine was placed in production.

Because of foresighted development, initial production was easily maintained at 1000 tpd. Ore is hoisted out a vertical shaft and fed to a 2,000-tpd mill. Concentrates from the mill are hauled by truck to Morristown and from there they are shipped by rail to New Jersey's smelters.

## TEXAS

**Fate of a first uranium mill for Texas, to be located 65 miles west of Corpus Christi seems dependent on Columbia Southern Chemical Co. licking a wet ore problem.**

The AEC has given southeast Texas allocation of reserves sufficient to handle run of ore at rate of 600 tpd until Dec. 31, 1966.

Associated with Columbia Southern in the venture was Union Carbide Nuclear Corp. (Union Carbide Corp.)

A 35-in. circular "shaft" and a 12-in. shaft sunk nearby, both to depth of about 350 ft, discloses the uranium to be deposited in pods in very wet ground emitting natural gas fumes. Drifts were driven off of the shafts in 0.25% average $U_3O_8$ ore.

Union Carbide is reported to have withdrawn from the project, which involved a joint corporate petition to AEC for concentrates contract (and mill), because of the economics of mining the Texas deposit.

However, the Homestake Mining Co. is now reported in the trade to be interested in the association.

## UTAH

**Delhi-Taylor,** which has projected a $20-million potash mine and refinery of 1,500-tpd capacity at its Cane Creek property, is reportedly near a deal with two unnamed chemical companies. Ore reserves at the property are sufficient for 40 years, according to Delhi. The beneficiated potash will be hoisted from the mill in the Colorado gorge up to nearby Bartlett Mesa from where it will be railed to Denver & Rio Grande Western Railroad's main line near Green River.

**United Park City Mines Co.** will sink a 200-ft winze from 1,800 ft to develop a new ore zone in the Ontario section of the mine. Substantial reserves were indicated by diamond drilling. Additional reserves were also found at a shallower depth on the Ontario section (at 1,000 ft) which had not been tapped by earlier mining.

## WASHINGTON

**Howe Sound Mining Co.** has sold the Holden mine at Chelan, once the largest copper producer in the state until its closure in 1957, to a group that intends to convert the townsite into a plush, year-around resort. Sale price has been reported at about $150,000. Up in Manitoba, Howe Sound's affiliate **Britannia Mining & Smelting** closed the Snow Lake gold property. All surface equipment has been sold to Machinery Center. In the first week of June, **Calera Mining Co.** shut down the open pit and concentrator at Cobalt, Idaho. The Government failed to extend the cobalt purchase contract under which the mine operated. Three months hence, Garfield will close.

**Pend Oreille Mines & Metals Co.** is looking to better times in the zinc business despite the stockpile of zinc concentrate being accumulated at the mine. The company will raise production to 10,000 tpd ore as soon "as prudent."

# IN CANADA

**The Canadian government** will likely ask private companies this summer to assist its Mines & Technical Surveys department in a crash program designed to whittle down the mountain of survey work to be done in the Arctic and sub-Arctic northland.

A request that private companies be hired has come from the Mines Committee of the House of Commons, in session, now looking over departmental estimates.

Canadian companies have done survey work for other countries, notably Pakistan and South Africa. But they have done little for the Canadian government, and that mainly in aerial photography.

The government mapping and charting program this summer calls for employment of 1,100 men in 81 individual survey parties. A topographical party using helicopters will extend surveys for mapping the mineral-rich areas of Labrador, and a similar party will be active in the Ungava region of northern Quebec.

A hydrographic party, sailing on a chartered sealer, will map Labrador coast areas and the east coast of Hudson Bay. Later in the season the ship will buck ice flows of Foxe Basin within the Arctic circle for more charting operations.

Topographical work will be carried out in the Winisk River area of northern Ontario, and in Hearst, Frantz, and Manitou areas north of Lake Superior.

All Canadian provinces are included with special attention on the north.

## NEWFOUNDLAND

**British Newfoundland Exploration Ltd.,** subsidiary of British Newfoundland Corp, is embarking on a $240,000 exploration program on its big concessions. The program includes airborne geophysical surveys over three areas, totalling 1,000 sq miles.

## WYOMING

**Lucky Mc Uranium Corp.** says its new concentrates sales contract with the AEC from July 1, 1959 to Dec. 31, 1966 will produce some $100-million in gross revenues. Allen D. Christensen, president of the Gas Hills firm which is 60% controlled by Utah Construction Co, says the contract will produce 1.7-million lb of $U_3O_8$ in concentrates a year. Christensen said that a total sale of 13,086,444 lb of $U_3O_8$ in concentrates is provided in the contract. Of the 5.6-million lb of $U_3O_8$ in an existing contract, 2,183,000 will be delivered to AEC before June 30, 1959, he said.

**Western Nuclear Corp.** has obtained a $6-million loan to finance expansion of its uranium mining operations in the Gas Hills area. Robert W. Adams, president, said $2,350,000 of the loan will be used to retire a previous loan and the balance will be used to expand Western Nuclear's mining operations and working capital.

**Labrador Mining & Exploration Co. is considering building a concentrator** on iron deposits in the Wabush Lake area. Negotiation has been under way between the company and Iron Ore Co. of Canada, whereby each would take over some of the deposits completely. Enormous deposits are reported to have been indicated in the area. Eight deposits have been completely drilled, the largest of which, the Carol, extends over a length of six miles with widths of 1,000 to 2,000 ft.

**Encouraging results are being obtained in underground work at the copper property** of Atlantic Coast Copper Corp. at Little Bay on Notre Dame Bay. Tonnage indicated by drilling around the old mine workings has been estimated at 2.61-million tons grading 2.11% Cu in one vein system extending to 1,550 ft. An additional 450,000 tons of possible ore is estimated in the vicinity of the mine workings. Development work is being carried on by O'Brien Gold Mines.

## ONTARIO

**The west zone at the gold producing mine of Cochenour Willans Gold Mines, in the Red Lake area,** appears to be lengthening with depth with the ore showing more continuity. Preliminary work, being carried out on the 13th and 14th levels, first of the new deep levels to be opened, is living up to earlier expectations. The mill, this year, is handling around 230 tpd.

**Macassa Mines celebrated** the pouring of the 2,000th bar of gold early in June, this year. Production at the veteran Kirkland Lake area mine started 26 years ago, the first gold bar having been poured on Nov. 1, 1933. Since 1933 output has totalled 1,228,000 ozs gold and 196,000 ozs silver, valued at over $44,-100,000.

*(Continued on p. 126)*

# This No. 12 has to be dependable because "if the trucks can't move, the mine can't operate"

The Cat No. 12 Motor Grader, maintaining a strip mine haul road in Kingwood, W. Va., is a key machine.

"Keeping the haul road open for 14 to 27 trucks to move 1,000 tons of coal a day is vital. If the trucks can't move, the mine can't operate," explains C. G. Robertson, vice president of the Kingwood Mining Company. "The reason we use a Caterpillar machine is there is less down time and it's economical to operate."

This No. 12 operates the year around, 96 hours a week. It works over the 3½-mile haul road in just four hours. Other times it is used for clean-up work.

There are a number of reasons for its high production and dependability. Operators have good visibility. The mechanical controls they operate offer positive action, make blade adjustments precise. And now the all-transistor Preco Automatic Blade Control is available. It controls blade slope to an accuracy of ⅛ of an inch in 10 feet regardless of position of the grader or the unevenness of the terrain.

Another exclusive is the oil clutch which provides up to 2,000 hours without adjustment.

The 115 HP No. 12 is just one of a family of Caterpillar Motor Graders designed to do more work at lower cost with less down time than any other units in their class. There is also the 75 HP No. 112 and the big, new 150 HP turbocharged No. 14—the most versatile big grader ever developed.

If you have a job that can't afford excessive down time, see your Caterpillar Dealer. Ask to see the Cat Motor Grader that best fits your needs.

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LESS DOWN TIME,
MORE PRODUCTION...
CAT MOTOR GRADERS

## Ontario *(Continued)*

**Coldstream Copper Mines has re-opened its former copper producing mine, 70 miles west of the lakehead.** The mine workings have been pumped out in preparation for further work. The Noranda Mines' controlled company will require additional financing to resume production and is expected to undergo some form of capital reorganization.

**First 1959 ore from Steep Rock Iron Mines, Ltd. reached the Canadian National Ry.** docks at Port Arthur on April 22d. The first boat—the *Frontenac* of the Cleveland Cliffs Iron Co. fleet—with 12,236 tons, was loaded on April 25th. for the Mc Louth Steel Corp. at Trenton, Michigan. Steep Rock expects to produce about 2.2-million tons during the 1959 ore season, as reported earlier in May, p. 158. The ore will come from the Errington underground mine, the Hogarth pit and the new Barrier pit. The Hogarth underground mine is being developed.

**Montreal Trust Co. has been appointed receiver and manager of the assets of Stanrock Uranium Mines Ltd.** by the Supreme Court of Ontario and intends to continue operations at the property in the Blind River area without interruption.

Mining and milling operations will be under the direction of Jon Metz who is presently making a thorough investigation of mining operations and the property.

## QUEBEC

**Bevcon Mines has added another neighboring mine, Buffadison, to its gold producing operations in the Louvicourt area.** However, final conclusion of the deal awaits approval of Buffadison Gold Mines' shareholders. In previous operations, the Buffadison mine was developed by a 1,000-ft shaft with lateral work on six levels. This work partially developed 250,000 tons of medium grade ore. Bevcon's other outside mine, the former Obaska Lake property, is being prepared for production with current work being concentrated on underground diamond drilling.

**Copper Rand Chibougamau Mines is aiming for start of milling before the end of this year.** Surface construction is making good progress at the Chibougamau area copper property. The company is planning to handle ore from three sources in the immediate vicinity. It is expected that Chibougamau Jaculet Mines, under Copper Rand control, will ship about 200 tpd and Portage Island (Chibougamau) Mines will provide up to 800 tpd, depending on development results. The Copper Rand property is expected to provide about 1,000 tpd.

**Molybdenite Corp. of Canada plans to deepen the shaft at its molybdenum producing property in the LaCorne-Malartic area.** The work is designed to investigate drill indicated extensions of ore and will provide two additional levels down to 1,000-ft depth. Blocked reserves at the end of 1958 stood at 205,558 tons, against 180,983 tons a year earlier. In addition, estimate of probable reserves was 429,123 tons, all above the 750-ft level. Between the 750 and 1,000-ft horizons, drilling indicated over 100,000 tons.

**Campbell Chibougamau Mines has issued a revised tonnage estimate** of the Henderson and Henderson offset zones at its property in the Chibougamau area. The estimate is based on results of the drilling program carried out during the past winter. Tonnage is calculated at approximately 6.5-million tons grading around 2.5% Cu and 0.05 oz gold per ton. Further drilling is expected to add to this figure. Sinking of a shaft to open up the Henderson zone deposit is currently under way.

**Robert Lafleur, president of Hull Iron Mines Ltd.,** states that assays of mineral at the deposits north of Hull have revealed iron content exceeding 50%. He said production at the mine is expected to start before August.

Lafleur said ore from the mines will supply Quebec's first integrated steel mill which Quebec South Shore Steel Corp., now parent company of Hull Iron Mines Ltd., claims it will start building this summer.

He said Quebec South Shore will operate a smelter and rolling mill which will be designed to produce 105,000 tons annually of pig iron, semi-steel, bars, angles, shapes and reinforcing rods. Based on estimated production of Quebec South Shore, Hull Iron Mines has now raised its own estimate of known blocked reserves to 20 years of operation. Hull's plans for the Ironside orebody were detailed in May, p. 114.

## NORTHWEST TERRITORIES

**High grade ore is being developed by work underway at Cons. Discovery Yellowknife Mines Ltd. on the new block of four levels below the 2,750 foot horizon, a substantial improvement gradewise over the preceding four levels.** Drifting for a length of 159 ft to date on the 2,900-ft level averages 2.46 oz per ton over a width of 4 ft. Previous flat drilling at this horizon had indicated less than 1 oz grade over a 2-ft width. Flat diamond drilling completed from the crosscut at the 3,050-ft level averages 2.86 oz per ton over a width of 2 ft. Drifting in ore will be underway at this horizon soon. Crosscutting has not yet advanced far enough to outline the ore by drilling at the 3,200-ft level. Drilling from the crosscut at the bottom 3,350-ft level indicates a grade of 2 oz per ton over 2 ft.

An inclined raise going up from the west end of the orebody on the 2,750-ft level is also in excellent grade ore. Chip sampling for a raise length of 100 ft averages 1.97 oz over a 5-ft width.

**Large reserves of rare volcanic shale from** which a high-grade pozzolana can be processed have been discovered on Vancouver Island. The discovery of the mineral may gradually bring about some drastic changes in the cement and construction industry in British Columbia.

The discovery at Rogers Creek near Alberni, is estimated at 100-million tons, and tests indicate it to be of excellent grade, matching at least, the El Paso product.

Holdfast Natural Resources Ltd. has been set up to develop the deposit, build a plant at the site, manufacture and market the pozzolana.

Very little pozzolana has been used in B. C., and that which has been used has been imported at high cost—a cost much higher per ton than cement. Economic studies indicate Holdfast's product can be profitably marketed.

A 100-tpd plant is planned with provision for expansion. The operation simply involves open-pit mining, crushing and heating in a kiln.

**The only major pumice deposit in British Columbia will be developed** by John McIsaac of Whitehorse with autumn production anticipated at a cost of $600,000. The deposit is 38 miles up the Lillooet River from Pemberton on a lease covering 563 acres. There is visible pumice (20-million yd) estimated of unusual purity on a cliff face 220-ft high and 2,600-ft wide.

# IN LATIN AMERICA

## PERU

**Two German metallurgists, who will study the feasibility of installing lead and zinc refining plants in Peru,** arrived in Lima in May for a six-week visit to this country.

They have come to Peru under the auspices of the West German Government and will carry out their studies in collaboration with the Peruvian Technical Committee for the Defense of Lead and Zinc. The visiting metallurgists are Messrs. Hermann Wilhelm and Loeth Ludwig. They will be joined later by Prof. Grothe, who will assist in drafting the final report.

## BOLIVIA

**In the near future,** the Bolivian government will establish an autonomous Institution in order to centralize and make a comprehensive inventory of this country's natural resources. The Institution will accomplish the following:

a) Inventory Bolivia's natural resources.

b) Prepare plans for the development of these resources.

c) Command the verification on in-

*(Continued on p. 133)*

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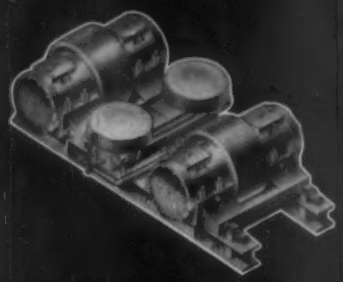
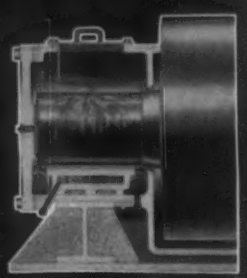


Standard roller support made with cast steel or forged steel rollers mounted on forged steel shafts.



Oil reservoir and oiling mechanism distributing oil over the shaft in a Traylor single support roller bearing.

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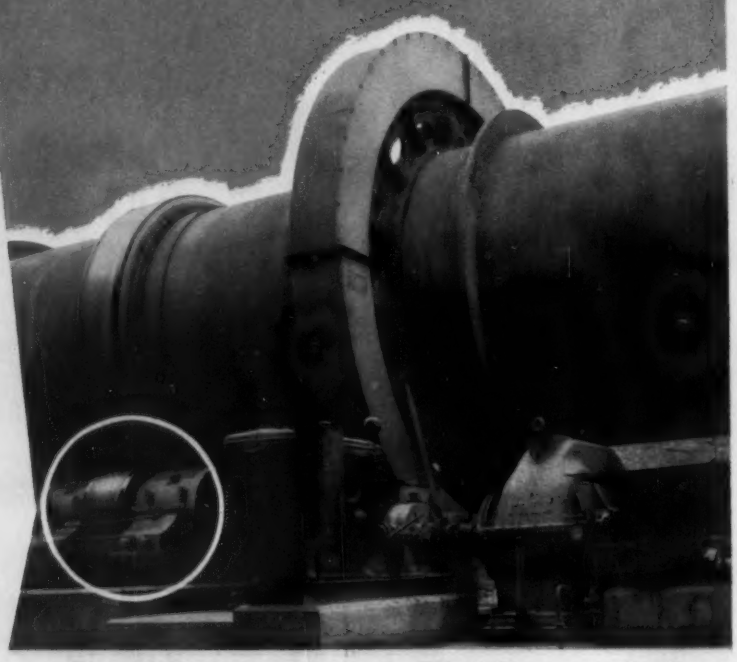

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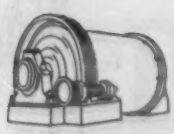

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SECONDARY GYRATORY CRUSHERS

# NO SHIFTING REQUIRED

## to back this JOHN DEERE Diesel Loader

The clutch-type direction reverser does it—puts the tractor into reverse or forward, maintaining a constant working speed, and adding extra tons to your day's work output.

Production gets another boost from this loader's self-leveling bucket. Dumped from full height, bucket returns to digging angle by use of the boom-control only. Same bucket action speeds light grading. In heavy digging, a 35-degree bucket roll-back provides plenty of power to insure full loads in a hurry.

Your dealer has more information about the many cost-cutting features built into this compact, highly maneuverable Diesel loader. And he's ready to show you how easily you can own it through terms of the John Deere Credit Plan. Have him set up a demonstration at your convenience.

**Basics on the JOHN DEERE CRAWLER-LOADER**

Pry-Out Pressure 8500 pounds
Dumping Clearance.... 10 feet
Dumping Angle at Full Height..... 50 degrees
Capacity, Heaped... 7/8 yard

*John Deere Industrial Division, Dept. 568, Moline, Illinois*

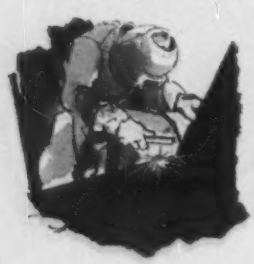
**JOHN DEERE** "*Specialists in Low-Cost Power with a Heavyweight Punch*"

*Serving industry with steels that fit the job*

# GET TOUGH

## WITH LUKENS "T-1" STEEL
TRADEMARK

Where the going gets rough, versatile Lukens "T-1" steel fights back. For repair or modification of heavy duty equipment such as truck beds, chutes, bucket teeth and dozer blades, this special duty steel plate can be ordered from *warehouse stock* in a wide range of plate sizes and gages. Lukens "T-1" is the modern mining steel—you can work and weld it in the field as readily as in your shop. Its terrific resistance to abrasive impact—coupled with an extremely high yield strength—means fewer replacements and often greater payloads. That's why more and more equipment builders are using Lukens "T-1" to provide longer life in shovel buckets, trucks and other mining equipment. Remember to specify the extra-tough 321 min. BHN quality. For performance and application details, request our special booklet, "Lukens 'T-1' for Toughness." Address Manager, Application Engineering Dept. **N79** Services Bldg., Lukens Steel Company, Coatesville, Pennsylvania.



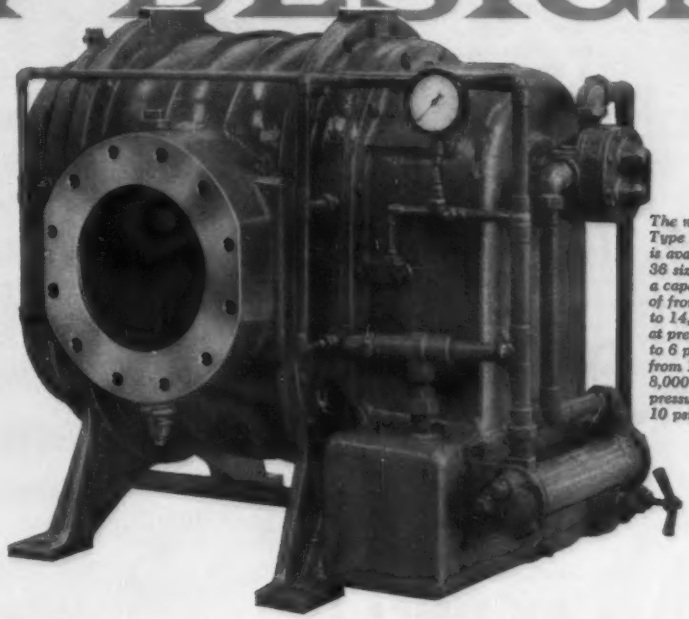
**These warehouses can supply you with Lukens "T-1" steel plate...**

**Alabama,** BIRMINGHAM 2, O'Neal Steel, Inc., P.O. Box 2623 • **California,** LOS ANGELES 54, Earle M. Jorgensen Co., P.O. Box 2358, Terminal Annex. 10650 S. Alameda St. • LOS ANGELES 33, The R. J. M. Company, 238-248 South Mission Rd. • **Illinois,** CHICAGO 8, Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts. • **Kentucky,** ASHLAND, Mansbach Steel Co., 19th St. and River Front • **Maryland,** BALTIMORE 2, Wm. G. Wetherall, Inc. 317 President St. • **New Mexico,** ALBUQUERQUE, Miller and Smith Mfg. Co., Inc., 500 Phoenix Ave., N. W. • **Ohio,** CLEVELAND 6, Mills-Wolf Steel Co., 12434 Cedar Rd. • **Oregon,** PORTLAND 4, J. E. Haseltine & Co., 115 S. W. Second Ave. • **Pennsylvania,** McKEES ROCKS, Follansbee Metals Division, 200 Bradley St. • **Quebec,** MONTREAL, Drummond, McCall & Co., Ltd., 930 Wellington St. • **Utah,** SALT LAKE CITY, Structural Steel & Forge Co., P.O. Box 300 • **Washington,** SEATTLE 4, Stack Steel & Supply Co., 500 Landers St. • SPOKANE 10, Union Iron Works, East 217 Montgomery Ave., P.O. Box 2135.

LUKENS

# NEW-DESIGN

## R-C blower delivers more CFM



*The new R-C Type RAS Blower is available in 36 sizes covering a capacity range of from 2,000 to 14,000 cfm at pressures to 6 psig and from 1,500 to 8,000 cfm at pressures to 10 psig.*

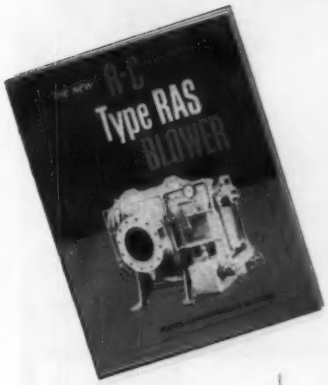
## AT LOWER POWER COST

A new, high-performance R-C rotary positive blower (designated Type RAS) features two important design improvements. *First,* a new "segment waist" impeller contour that increases the volumetric efficiency of the blower. *Second,* a new vertical arrangement of the impellers that increases application flexibility.

The design of the "segment waist" impeller contour permits a higher pressure rating for a given impeller length. This in turn delivers greater displacement per revolution without increasing operating speed and at a lower power cost. And, in addition to being more quiet in operation, the design permits safe handling of entrained liquids.

The vertical arrangement of the impellers provides horizontal inlet and discharge connections for more convenient, simplified piping. Extremely compact, the blower also offers substantial savings in space requirements. And, as with all R-C rotary positive blowers, air delivered is free from oil vapors and other contaminants.

Roots-Connersville RAS blowers offer many advantages—exclusive rotary positive design, ease of installation, efficiency of operation, and long years of trouble-free service. These features are the result of R-C's specialized experience of more than 100 years in the design and application of air and gas handling equipment.




*For gas service too...* This same new design is also available in pumps for gas service. Designated Type RGS, the gas pumps differ from Type RAS Blowers only in that a mechanical face type seal is used instead of a lip seal.

*For additional data, please refer to pages 565-568 in* **Chemical Engineering Catalog,** *our section in* **Mechanical Catalog,** *or write for* **Bulletin RAS-158.**

**ROOTS-CONNERSVILLE BLOWER**
**DIVISION OF DRESSER INDUSTRIES, INC.**
759 Washington Ave., Connersville, Indiana. In Canada—
629 Adelaide St., W., Toronto

# THE RIGHT BIT.. FOR YOUR JOB!

## And it's there ON TIME!

With plants located throughout the world, Christensen meets your drilling requirements with the right bit, on the job, in time —

**RESETTING** — Your used diamonds can be reset in the same bit style or type. Your bit style can be changed to meet any new drilling requirement. You are billed only for the new diamonds, plus a nominal fee for setting. Regardless of type or manufacture of core barrel presently in use, we can complete your order of diamond bits or shells to fit its specifications.

**TIME** — Your new style or reset bit can be shipped within five working days after your order has been received.

**CORE BARRELS** — For standard equipment listed in our catalog SD 507, a maximum of two days is required before shipment, and frequently shipment is made the same day your order is received. Custom designed core barrels manufactured to any size and specification — let us quote you price and delivery.

**MISCELLANEOUS DRILLING SUPPLIES** — As a convenience to our customers, drill rod, casing, handling and fishing tools are also available.

**The combination of Christensen's experience and unequaled service assures you of "less cost per foot", regardless of job location.**

**Call Christensen today!**

*Diamonds Mean, "Less cost per foot."*

**CHRISTENSEN DIAMOND PRODUCTS**

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

## Bolivia *(Continued)*

ventories to the competent institutions on each case, and centralize the data.

Meantime, an important part in the work of the autonomous Institution is at the begining of its operations: the Geological Service of Bolivia is being organized by a German geological mission in cooperation with the Ministry of Mines, Mining Corp. of Bolivia and La Paz University. This mission arrived recently with the necessary equipment and vehicles, all expenses paid by the Bonn federal government, except quarters and offices, to be supplied by Bolivian government. The Service will make the inventory as far as concerned with mineral resources.

On the other hand, government is planning to create two seismological stations, and other facilities aimed to the good success of the inventory work.

**Mining Corporation of Bolivia** (Corporacion Minera de Bolivia) made public the following figures, that show the declining of exports for March, 1959 in comparison to March, 1958. "The decrease," explains MCB, "is because the recent general strike in nationalized mines, due to the suspension of old system of cheap foods in mining centers."

"Decrease in production," said MCB, "is not however affecting the fulfillment of Bolivian committments with International Tin Council, or the recent interchange operation agreement with Philipp Brothers and C. Tennant, both of New York."

Percentages of decline in March 1959 exports in comparison with March 1958 exports give an average of 64% decrease, and are the following:

Tin, 40.08; wolfram, 56.68; zinc, 91.79; lead, 78.74; silver, 78.31; copper, 77.72; and bismuth, 23.12.

## BRAZIL

**The government-owned Cia. Vale do Rio Doce, Brazil's largest iron ore exporter saw its volume of exports drop from 3.5-million tons in 1957 to 2.9-million in 1958;** and it's estimated that exports this year will probably not top the 3-million mark either. Nevertheless, profits increased during 1958 to Cr$1,093-million; up from Cr$737-million in 1957.

During 1958, the company picked up two new customers, Poland and Czechoslovakia, who together took over 20% of total exports, compared with 32% for the U.S. This year, yet another new customer, Japan, is running ahead of all other countries and promises to be a big consumer in the future.

Rio Doce is one of the few Government-owned enterprises in Brazil that actually operate at a profit—the other is the Volta Redonda steel mill—and its financial position is very strong. Right now the company is carrying out an expansion program which will give it an export capacity of six-million tons annually. Two new loading docks are being built and its own railroad is being re-equipped with a $12-million loan from the XIM Bank. Incidentally, the company is right up to date on repayments of a previous $16-million loan from the Bank and intends to liquidate it before its actual due date.

In order to utilize this new export capacity the company intends to change its export policy. In the past, only top grade ore has been exported mainly because export capacity was limited by rail and port installations so the company wanted to obtain top prices for what it could export. But when the expansion program is completed, Rio Doce will also offer 'fines' and 'run of mine' grades since it is considered that it will be easier to dispose of these cheaper grades of ore on the world market.

## CHILE

**Mr. A. Andai, president of Santa Fe Mining Co.** (see E&MJ Feb., p. 230 and March, p. 154) which last year exported 187,000 tons of iron ore, is trying to find a credit for $250-million in the U.S. and Europe to finance the exploitation of El Laco iron deposit which is said to contain between 1- and 3-billion tons of over 60% iron ore. El Laco is about 250 miles East of Antofagasta.

(*Continued on p. 134*)

Designed to new engineering standards

CROSBY-LAUGHLIN Load-Rated* HOOKS

give you highest capacity per size

- 100% drop forged . . . heat treated
- Guaranteed not to break
- Most complete line, carbon or alloy steel
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*Easily converted to safety hook at any time*

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Buy Genuine Crosby-Laughlin . . . the hooks that are painted red.
*trademark

## Chile *(Continued)*

**Braden Copper Co.** has again obtained the 1958 safety award in class "A" companies, that is, those with more than 5,000 employees. This is the twelfth obtained in succession. Braden's record was 4.87 and the company following, 17.07.

**Rio Blanco Mining Co.,** a subsidiary of Cerro de Pasco Corp., which already has reserves of 100-million tons of 1.6% Cu ore some 50 miles from Santiago at an altitude of 13,000 ft, has solicited from the government the water rights to build a 22,000-kw hydroelectric power plant for the mine and mill near El Saladillo.

**A Canadian firm has bought the well known El Paposo iron deposit from its Chilean owners.** El Paposo is east of the old nitrate port of Taltal. Purchase price was $500,000.

**Compañia Peñarroya,** a well-known French mining company with important lead-zinc mines in Spain, now controls Cia. Minera Disputada and has acquired all the assets of Cie. Miniere du M Zaita. Thereby, Peñarroya now controls the two largest medium size copper mines and mills in Chile which treat 770 and 1,200 tpd of copper ore. Peñarroya plans to build a new mill for Disputada mine to treat 3,000 tpd. This company also plans to reconstruct the old Cl.agres smelter which stopped smelting in 1945 at the end of the World War II.

**Mitsubishi Mining Co.,** owner of the 14-million tons high-grade iron ore "Las Adrianitas" to the NW of the town of Copiapó, plans to build a 40-mile road to the sea at a cost of $1.5-million, as well as a mechanized loading wharf at the same cost.

Mitsubishi plans to start mining at the rate of a half million tons of ore a year to be increased to 800,000 tons after two years. (Also see E&MJ June, p. 388 for earlier reports on the mine.)

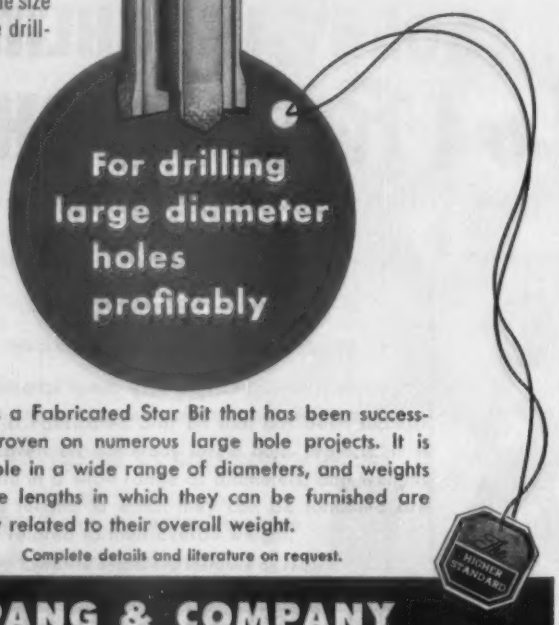
**Mr. Guggenheim,** president of Anglo-Lautaro Nitrate Co. has announced that his company plans to spend another $10-million in its Chilean nitrate plants of María Elena and Pedro de Valdivia to develop systems to recover salts that at the present time are lost in the tailings. The main feature of such methods is the solar evaporation system.

**The mill of El Salvador,** Anaconda's new Chilean porphyry copper, is now on-stream with 2 of its sections and doing over 10,000 tons per day. This mill has 4 sections of 6,000 tons each. Capacity is, therefore, 24,000 tons of ore per day.


FABRICATED STAR BITS

The Fabricated Star Bit shown here has been designed especially for big hole drilling in hard formations. Far more efficient than the old style spudding bit and the big hole paddle-type bit, these Star Bits are custom-engineered to suit the particular hole size and the capacity of the drilling machine used.

Spang Fabricated Star Bits save labor and money. They can be quickly dressed to gauge, and speedily ready for drilling, by hard surfacing the cutting edge.




Here is a Fabricated Star Bit that has been successfully proven on numerous large hole projects. It is available in a wide range of diameters, and weights . . . the lengths in which they can be furnished are directly related to their overall weight.

Complete details and literature on request.

SPANG & COMPANY

DEPT. M-2 BUTLER, PENNSYLVANIA

For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.


## MEXICO

**The Mexican government formally took control of phosphate deposits on the Peninsula of Lower California.** The government gave no reason for the act except that it felt the phosphate deposits should be put in the government's national mineral reserves. Mexico's Comision de Fomento Minero (National Commission for Minerals Development) will be the titular head of the new deposits.

**Fomento Minero** has been experimenting in Saltillo with a small pilot plant for making superphosphates for fertilizer from phosphate rock found in Mexico. Mexico has a crash program underway to build up its own supply of fertilizer to put into much needed agricultural programs.

**PEMEX,** the national oil company, is building three anhydrous ammonia plants this year to give more raw materials to fertilizer manufacturers.

**Guanos y Fertilizantes,** the big government fertilizer plant, has been using an increasing amount of phosphates for its fertilizer program. Mexico has been importing most of its phosphates for fertilizers even though there are some unexploited deposits of phosphate rock in the country.

It is believed that the government may be readying to use its own phosphate to put into fertilizers in order to cut down the growing imports. Whether the government plans to take over other phosphate deposits in Mexico, other than those in Lower California, remains to be seen.

**In Africa starts on p. 138**

Announcing **WORLD'S TOUGHEST OFF-ROAD TIRE!**

All-New Nylon U. S. Royal Super Con-Trak-Tor with ...69% to 95% Longer Tire Life!

S.R.T.*

Steel Reinforced Tread*

New S.R.T.—as shown here in the X-Ray photo—is a **tough** reinforcement of tread, shoulder and buttress areas. It consists of several thick layers of tread rubber containing thousands of short lengths of brass-coated steel filaments. This forms a virtually **impenetrable** mat between the tread and nylon cord body and extends down through the shoulder and buttress areas providing **positive** protection against combination cut-and-impact failures!

Add to exclusive Steel Reinforced Tread... 50% deeper tread at center... far deeper tread at shoulder... 25% more ground contact... Double-Strength Nylon and you have the world's **toughest** off-road tire! No wonder the great new U. S. Royal Super Con-Trak-Tor-S.R.T. outperformed **every** tire put against it—by the widest of margins—up to 95%! Can you afford less on **your** jobs?

**U.S. ROYAL** SAFETY 1st **TRUCK TIRES**

US RUBBER **United States Rubber**

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# New SPECIALIZED

## Harbison-Walker Refractories meet the intensified conditions of today's aluminum industry

Within the last couple decades the production of aluminum metal in the United States has trebled and the number of its alloys has increased manyfold. Rapid evolutionary developments created the need for refractories to meet new conditions. The severity of corrosion, more destructive impact accompanying furnace charging and the necessity of avoiding contaminants for meeting rigid alloy specifications—these among other factors have become increasingly important.

Since the first commercial production of aluminum and its alloys, Harbison-Walker brands, primarily of alumina-silica and high-alumina compositions, have continued to fulfill the ever-growing demands. Through unceasing research several refractories, recently developed specifically for aluminum melting furnaces, possess definitely superior properties for maximum durability and best quality of metal. Harbison-Walker's CORALITE XX (85% alumina brick) has established excellent service records in aluminum furnace bottoms and side walls. Several modifications with enhanced properties now are in commercial production.

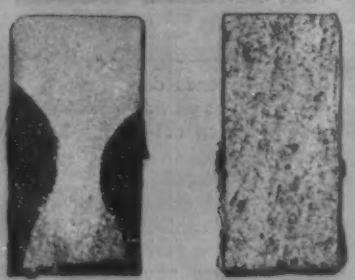
These unique refractories expecially suited for aluminum melting furnaces are here briefly described.

**CORALITE 22-58** is a stabilized aluminum phosphate bonded brick containing approximately 85% alumina. It has exceedingly high strength and withstands greater impact and abrasion. Its resistance to wetting and penetration by the molten metal are properties of paramount importance. CORALITE 24-59 is the hard-fired variation, having still higher mechanical strength.

**CORALITE 3-59** is a very hard-burned brick containing approximately 85% alumina. It is made with a special bond (patent pending) which contributes to its remarkable strength. As illustrated by the photograph showing results of the laboratory tests, it is exceedingly resistant to penetration and reaction with molten aluminum.

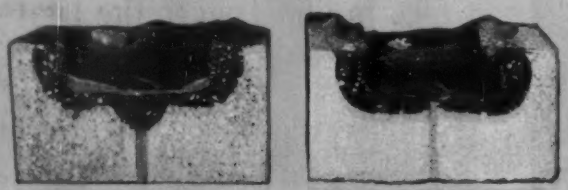
**CORALBOND** is a phosphate bonded high alumina mortar developed specifically for use in aluminum melting furnaces. Among numerous mortars of many compositions, CORALBOND is very outstanding in its resistance to penetration and corrosion by aluminum alloys at the furnace operating temperatures.

**ALUMINUM IMMERSION TEST**



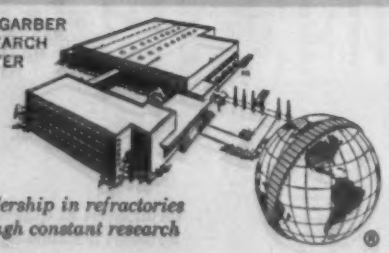
These brick, which were immersed in aluminum alloy at 1400°F. for nine days, show contrast in degree of penetration or wetting between a normal high alumina brick, left, and CORALITE 3-59, right.

**MORTAR JOINT TEST**



Photograph of Laboratory "Cup Tests" with molten aluminum alloy, shows striking difference in resistance to penetration and corrosion between a widely-used air-setting bonding mortar at the left and the CORALBOND joint at the right. Among many mortars of widely different compositions, CORALBOND—as illustrated in this test—is unmatched.

THE GARBER RESEARCH CENTER



*Leadership in refractories through constant research*

**HARBISON-WALKER REFRACTORIES COMPANY**

AND SUBSIDIARIES — GENERAL OFFICES: PITTSBURGH 22, PENNSYLVANIA

*World's Most Complete Refractories Service*

# Du Pont Announces the ACUDET® SERIES of Delay Electric Blasting Caps

## Greater Dependability and Accuracy

A new series of delay electric blasting caps with accurately spaced delay intervals which eliminates all possibility of overlapping—a major forward step in delay blasting control.

The new Du Pont Acudet® Delay Electric Blasting Caps provide new standards of accuracy and dependability in regular delay blasting. Manufactured to closer timing tolerances than ever before possible, the new series assures positive intervals of ⅒ to ½ second between each period throughout the entire series of 14 delays.

There are 14 delay periods available in the Acudet series with a total spread of 8½ seconds. The timing of each period has been carefully selected in order to provide optimum blasting results.

## No arcing failures

The Acudet Series of delays can be fired in series, straight parallel, or parallel series hookups without arcing failures at any voltage commonly used. When the first-period Acudet Delay fires in ⅒ of a second and breaks the circuit, damaging arcs do not have time to form. This eliminates the need for a special circuit-breaking cap in the lead line or for expensive special timing equipment with its limitations.

Field experience with Du Pont Acudet Delays has shown the following advantages:

1. More muck per round—less bootleg.
2. No loose powder in the muck pile—increased safety.
3. Easier loading—more uniform fragmentation.
4. Easier to make primers—Acudet Delays are shorter.
5. Corrosion resistant aluminum shells.*

In common with all other Du Pont Electric Blasting Caps, Acudet Delays are mechanically assembled with nylon plastic insulation on the leg wires, rubber plug closures and shielded shunts.

For further information, contact your Du Pont Explosives representative or write to E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Delaware.

**Copper shells on request*

DU PONT EXPLOSIVES

REG. U.S. PAT. OFF.

**Better Things for Better Living . . . *through Chemistry***

## VENEZUELA

**Orinoco Mining Co.**, Venezuelan subsidiary of U.S. Steel, has opened a new channel with minimum year-around draft of 30 ft and minimum width of 400 ft through the delta of the Orinoco River for shipment of iron ore from its Cerro Bolivar workings.

The channel will permit two-way traffic of deep-draft ore carriers over a 184-nautical mile waterway between Puerto Ordaz and the Atlantic Ocean. A total of 1,065 carriers called at Orinoco Mining's loading facilities at Puerto Ordaz last year.

The new channel utilizing the Boca Grande arm of the River is 139 nautical miles long. It was completed at a cost of $9.3-million under a contract arrangement with Venezuela's National Institute of Waterways.

The Boca Grande channel replaces a shorter but more sinuous channel 109 nautical miles in length which utilizes the Caño Macareo arm of the River. The Caño Macareo channel, with minimum depth of 24 ft and minimum width of 197 ft, will be abandoned after a trial period.

Work on the Boca Grande channel was commenced in late 1956, using a new type of boom dredge (a converted 16,000-ton T-2 oil tanker) designed especially for the job.

Longest dredged section is a 26-nautical mile channel extending into the open Atlantic through the bar at the mouth of Boca Grande. In addition, two sections of river totaling 5½ nautical miles were dredged upstream.

Orinoco Mining dredges and maintains the waterway from Puerto Ordaz to the sea under a 50-year contract with the Institute of Waterways, which sets and collects tolls. The Institute turns over 90% of receipts to Orinoco Mining for maintenance of the channel and eventual amortization of its initial cost.

Above the juncture of the Boca Grande and Caño Macareo at the head of the delta, the original channel continues in service in the mainstream of the Orinoco River for a distance of 45 nautical miles to Puerto Ordaz. Rock is being blasted in the river bed at a control point near Puerto Ordaz to complete a 30-ft channel for the entire route between Puerto Ordaz and the sea.

Dredging will continue to deepen the channel to 34 ft, at an estimated additional cost of $6-million.

Lower maintenance costs of the new channel are expected to result in an eventual reduction of toll charges for use of the channel. The toll has been progressively reduced since opening of the original channel in 1954, and is presently set at 84c per ton of cargo.

The new channel was opened because of rising maintenance dredging costs—as high as $5-million annually in the old channel—and increased navigational hazards due to heavier traffic. The Caño Macareo has several sharp bends including a double hairpin.

Ore carriers as big as the 80,000-ton *Ore Chief* class have used the channel in the past during periods of high water, carrying partial loads.

*Courtesy Johannesburg Star*

**BAMANGWATO** leaders who met with RST were—Tshekadi Khama (left) who died June 10th, former regent and uncle of Seretse Khama (center), and Rasebolai Kgamane.

## Selection Trust Opens Up Bechuanaland

**Rhodesian Selection Trust Copperming Group** has announced an agreement with the Bamangwato tribe for prospecting rights over 40,000 sq miles of Bechuanaland. RST will have Mond Nickel Exploration Ltd., Toronto and Minerals Separation Ltd., of London as associates in carrying out the agreement. The announcement follows an earlier statement by RST which said the group had decided to develop an additional copper orebody to the west of its existing Chibuluma mine on the Northern Rhodesian copperbelt. Rhodesian Selection Trust is associated with American Metal Climax Inc., N.Y., which has a majority interest in the Group.

The agreement was signed June 2 at Serowe, capital of Bechuanaland, by Rhodesian Copper and the African authorities for the Bamangwato tribe. In the prospecting agreement the region concerned covers virtually the whole of Bamangwato's tribal area. An official statement issued recently says that the contract has been concluded with the knowledge and approval of the British government.

After a predetermined period of preliminary investigation RST may form a company which will have rights to prospect and explore the area for a period of up to 10 years and that in the event of mineral discoveries of economic significance being made, mining rights will be exercisable by the Group or by mining companies formed by the Group. Mining companies so formed would pay royalties to the Bamangwato Tribe on predetermined basis. The announcement comes as one of the best kept secrets of Rhodesian mining for many years.

Two years of negotiations have been going on between Sir Ronald Prain, Chairman of RST and the three best known leaders of Bamangwato tribe, Rasebolai Kgamane, Tshekedi Khama and Seretse Khama. These discussions have been reported at various times from Salisbury, London and Bechuanaland. But it had not been known to what stage the discussions had progressed.

Bamangwato's tribal area lies in the eastern part of Bechuanaland protectorate, with its northern boundary skirting the Makarikari Saltpan and the Southern Rhodesian border. The area is roughly the same size as RST's holdings in Northern Rhodesia. So far as is known the tribal area has never before been extensively explored for minerals and certainly no exploration has taken place on any scale with modern scientific equipment. Main railway line from South Africa to Rhodesia and the Belgian Congo runs through tribal lands for about 200 miles.

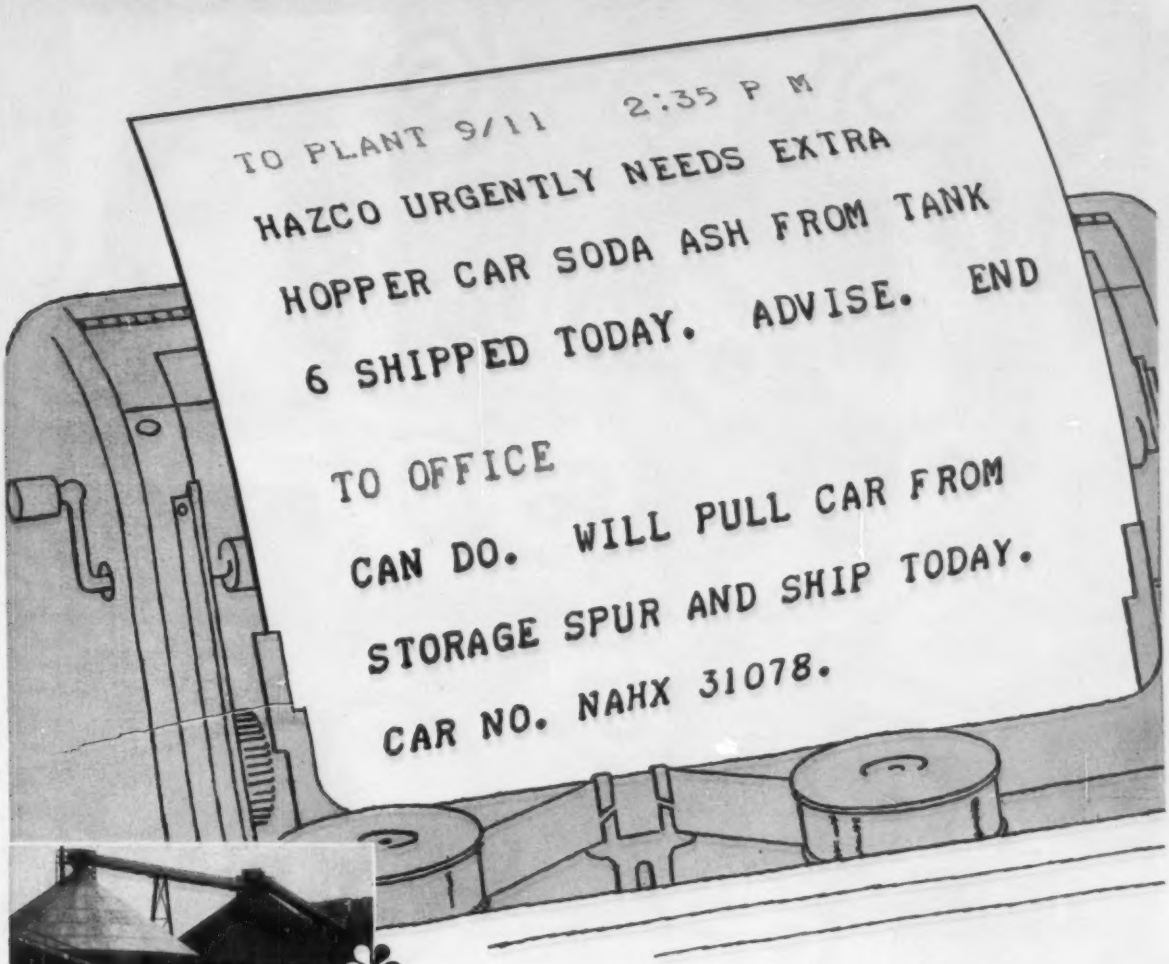
The earlier announcement of development work on an additional copper orebody stated that it contains approximately 2-million tons of copper assaying 4.81%. Development is to start immediately and production of an additional 4000 long tons of copper per year is expected in 1963. Development cost is estimated at £850,000.

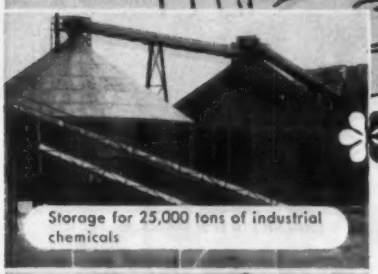
## IN AFRICA

**Several South African** uranium mines plan to be in a favorable production cost position by the time their contracts expire. Southern Rhodesian miners are disturbed by recent U.S. purchases of chromite from Russia. On the Witwatersrand, Western Deep is pushing shaft sinkings on four locations, while Merriespruit in Orange Free State continues to lower the water table in area mines.

**A new sliding scale of railway rates for carrying copper from the Northern Rhodesia Copperbelt to ports based on the price of copper on world markets,** is proposed in a report of a commission set up by the Central African Federal Government to enquire into the rating structure of the state-owned Railways.

# West End "fills the order"...


TO PLANT 9/11 2:35 P M
HAZCO URGENTLY NEEDS EXTRA
HOPPER CAR SODA ASH FROM TANK
6 SHIPPED TODAY. ADVISE. END
TO OFFICE
CAN DO. WILL PULL CAR FROM
STORAGE SPUR AND SHIP TODAY.
CAR NO. NAHX 31078.


Storage for 25,000 tons of industrial chemicals

Immediate shipment in leased hopper cars

Vast natural source of raw material

Meeting service requirements to the letter and producing superior soda ash of consistently accurate particle size and chemical analysis are the essentials to which the West End organization is uniquely geared. A system of rapid communications linking our sales office in Oakland with our production, technical and shipping departments at the desert plant site permits each department head to have a complete understanding of the customer's individual requirements and to make firm commitments or provide the desired information promptly.

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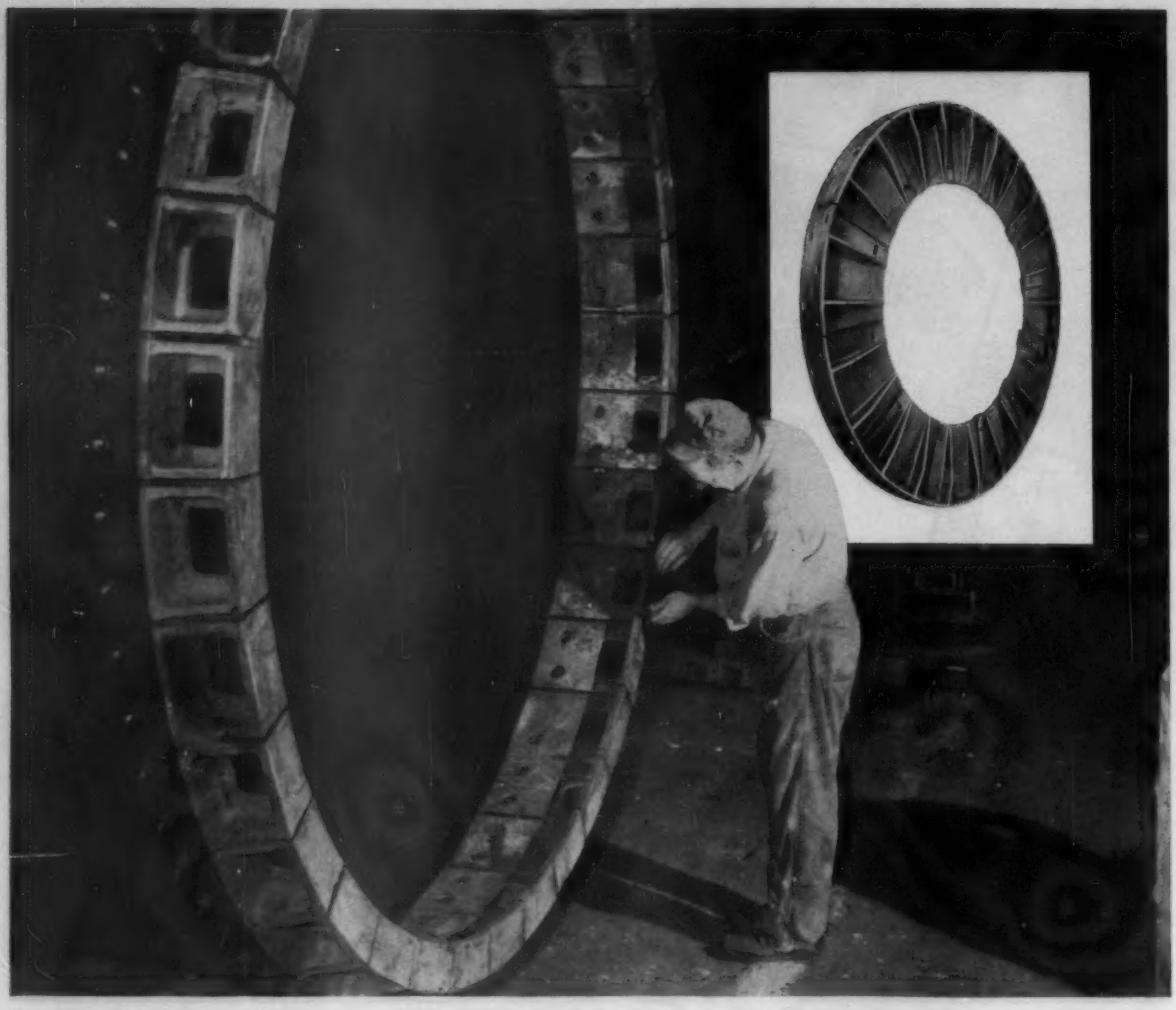
**WEST END CHEMICAL COMPANY**

EXECUTIVE OFFICES, 1956 WEBSTER, OAKLAND 12, CALIF. • PLANT, WESTEND, CALIF.

DIVISION OF Stauffer STAUFFER CHEMICAL COMPANY



**IN CEMENT, LIME, AND DOLOMITE PLANTS...**

# B&W Nose and Tail-Ring Castings Demonstrate Longer Continuous Service

Longer brick life and longer continuous service are being attained by 275 kilns in 54 plants using B&W Nose and Tail-Ring Castings. In many cases, the life of these castings has exceeded 9 years.

Light and strong B&W Alloy Castings have improved kiln performance in most installations. Made of heat-resisting Grade HH alloy, nose ring castings eliminate belling out of the kiln shell, assuring longer brick life and longer continuous operation of the kiln. By protecting the end of the kiln shell from direct flame, the nose ring castings prevent "feathering-down" of the shell because of oxidation. Their design eliminates cracking and warping, experienced with large size castings.

Small size and light weight make B&W Castings easy and inexpensive to install. The protecting flange on the nose ring castings permits the use of low-alloy steel bolts for fastening.

Spare part inventory may be kept low because the same nose ring castings may be used on kilns varying up to 4 feet in diameter, depending upon size. Write for Bulletin S-17. The Babcock & Wilcox Company, Boiler Division, Barberton, Ohio.

S-467

B&W THE BABCOCK & WILCOX COMPANY

BOILER DIVISION

# High Grade Results in Low Grade Ore

Two Marion 4161 machines are helping to point the way to high grade recovery of low grade ore in the Lake Superior region.

The diet of these machines is a hard, abrasive Jasper formation weighing 2.6 tons per yard. The Marions work on 40 foot benches in blasted pits ranging to 100 foot depths which may eventually reach 500 feet.

Let Marion mining machines, in a broad range of sizes and types, help you get high grade, high profit results.

CONSULT MARION MINING SPECIALISTS
*for lowest costs on your property!*

**MARION POWER SHOVEL COMPANY - MARION, OHIO, U.S.A.**
*A Division of Universal Marion Corporation*

## Africa *(Continued)*

If these proposals are accepted, the coppermining companies will save $1.4-million a year with copper at its present level, a saving which would drop to about $210,000 if the world copper price ranged between $672 and $728 a ton.

In explaining this system, the commission's report said that the general principle was that revenue from a particular traffic should not be lower than the direct cost of carrying it, and that the burden of overhead costs should be spread over the total traffic in accordance with the ability of each type of traffic to pay.

**Working costs at Mangula**—one of the Messina (Transvaal) Development Company's copper mines in Southern Rhodesia—are expected to drop about 80c of $3.08 per ton of ore treated, when planned production of 3,000 tons of ore a day is reached.

The second aerofall mill has been installed, and extensions have been made to the flotation plant. Full benefits of increased production should come to be in about a year.

**Despite the recent tension between the Soviet Union and the United Arab Republic over Iraq,** the Russians have continued to supply the industrial and mining equipment already contracted for under the 700-million ruble loan agreement of last year.

In the past weeks, Egyptian sources have reported the arrival of the following equipment in Egyptian ports from the USSR: equipment for the fine-weaving factory at Mit Ghamr; equipment for the exploitation of phosphate mines; equipment for the exploitation of manganese in the Elba region of the Eastern Desert; equipment for the exploitation of lead and zinc ore; drilling rigs for the General Petroleum Co.; and geophysical survey instruments.

**Western Rand Cons. Mines** will have simplified mining operations because of the higher grade found in the Bird Reef when its present contract expires. If present production continues, Wesern Rand will be able to treat a ton of ore for roughly 44s or $6.25—for a production cost of about $4.20/lb of $U_3O_8$.

**Daggafontein Mines Ltd.** discloses a production cost of 29s 3d ($4.15) a lb. The mine is showing a profit of 53s 10d or $7.50/lb produced. After expiration of its contract in 1963, the company's profit will be seriously reduced.

**The uranium division** of Randfontein reports a lower net production cost due to increased tonnage being mined and milled, but no figures are given.

**Southern Rhodesia's chromite reserves now total more than 500-million short tons at shallow depths,** according to a report published by RHODESIAN MINING & ENGINEERING JOURNAL. Chromite producers in the Federation are alarmed at the amount of chromite the U.S. is buying from Russia. It was reported in Africa that the U.S. bought 80,000 tons of Russian ore in January and February and only 53,000 tons from the Federation mines. Producers have asked the federal Minister of Commerce & Industry to take up the matter with Washington as they maintain that they can supply the additional tonnages and that their export market is already depressed without the additional handicap of Communist competition.

**Mineral production in Northern Rhodesia** during March was about $5-million more than the total in February for a March estimate of $19.5-million. Total mineral production for the first quarter of 1959 was about $87-million, an increase of one-third over same 1958 period. Biggest item in March was 28,183 tons of electrolytic and 17,567 tons of blister copper. Northern Rhodesia is now second behind the U.S. as a world copper producer.

**South African gold mining set another record in April** when aggregate production rose from a previous record of 1,593,467 oz in March to a new all-time mark of 1,653,706 oz worth £20,547,-297 ($57,532,000).

**Nigel Gold,** west of Johannesburg, is selling the last of its equipment after closing down in 1956.

*(Continued on p. 146)*


**Got water?** **Get FLYGT**

The B-150/200L FLYGT pump lifts *20 times its own weight* in water every minute! Its capacity is 3,000 GPM, yet it can be moved anywhere by panel truck and light crane (weight: 1,200 lbs.).

It is electric, fully submersible, requires no priming or installation. Like all FLYGT pumps, it needs practically no supervision or maintenance — can run dry without damage and takes a high proportion of solids without clogging.

B-150/200L data: 6" (high head) or 8" (high capacity) hose; 65 hp; 1,200 lbs; 3,000 GPM; max. head 220 ft.

**There is a FLYGT pump for every job:**

B-38L: 1½" hose; 1.8 hp; 79 lbs; 75 GPM; max. head 90 ft.
B-80L: 3" hose; 6 hp; 185 lbs; 330 GPM; max. head 170 ft.
B-80M: only 9" diameter; 3" hose; 6 hp; 140 lbs; 300 GPM; max. head 115 ft.
Higher heads with FLYGT pumps in tandem.

**FLYGT**

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1646 Ninth St.
(Corner of Olympic & Ninth)
Santa Monica, California.

EAST OF THE MISSISSIPPI:
STENBERG MANUFACTURING CORPORATION
Hoosick Falls, N.Y.

# Let's take a look at the facts about grinding mills

Comminution is a subject that is by no means new and perhaps more tons have been ground in discussion than in practice. But still it must be considered an art, not an exact science. Marcy realizes this as well as you do. However, we at Mine and Smelter take this art very seriously and apply as scientific an approach as is possible in recommending type, size and quality of mills for your requirements.

These Marcy Mills, whether they be rod mills with a high or low discharge level, or ball mills with Marcy grate design or the overflow type, are all "Custom Engineered" for *your* particular problem. There has never been a formula, capacity table, or performance curve developed which can be used to accurately select a mill for a specific job. A background of experience, applied with sound judgment, is essential for a successful solution of the problem. . . you cannot just select a size from "standard" models.

This engineering service, with final mill design based on hundreds of *field-proven* Marcy designs, carries no penalty in price. Of the *field-proven* features incorporated in the design of *your* Marcy Mill, many may be of recent development, some as old as grinding itself . . . but, the most important ingredient in the design of *your* mill is the extensive grinding experience by Marcy, which results in a design incorporating the correct combination of these field-proven features for *your* job . . . an ingredient which is responsible for Marcy's leadership in grinding.

***What is really new in mill design?*** A talk with Marcy engineers will provide you with an insight on this subject, including interesting facts about the past, present and future of grinding. We at Mine and Smelter favor continual progress, but we respect history as a teacher . . . a most worthy instructor for guiding future progress.

**"Custom Engineering" your Marcy Mill is our favorite subject . . . it could be yours, just contact . . .**

*Manufacturing Division*

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*The makers of* ***THE BIG E*** *announce . . .*

**ANOTHER ADVANCED DESIGN SERIES OF MODERN TRACTORS AND TRACTOR UNITS**

# the EIMCO 103

**NEW Power! NEW Maneuverability! NEW Unitized Construction!**

The Eimco Corporation, pioneer in MODERN Tractor engineering and design, now brings you the **first modern tractor** specifically engineered to fill your-size, power and work needs in the medium size tractor field **. . . the 103 series!**

**Eimco 103 — Tractor only**
**Eimco 103 — with Dozer attachments**
**Eimco 123 — Efficient Front End Loader**
**Eimco 133 — Special Steel Mill FEL**
**Eimco 143 — Log Loader**

## *LOOK AT THESE FEATURES . . .*

**100 horsepower** . . . General Motors or Cummins Diesel Engines of latest modern design.

**Quadra-Torque** . . . the new modern power team with four forward and four reverse gears. Permits shifts from any gear, forward or reverse, to any other, at any tractor or engine speed without slowing or stopping the tractor.

**Unidrive and Dual Final Drives** . . . Eimco engineered and built, with independent track operations for smooth, safe spin turns without track-drag. Simple, reliable, powerful!

**Up to 33,000 lbs. drawbar pull** . . . with adequate traction, through the Quadra-Torque-Unidrive-Torque Converter power team!

**Unitized "Stress Flow" Construction** . . . newest Eimco exclusive. Large, strong steel castings are molded to shape required, with thickness varied as required to withstand maximum stresses. Main frame, final drive and center housings one strong casting! No bolts or welds. Components readily accessible.

**Up-front operator position** . . . for maximum control and visibility.

**Simple controls** . . . with power shifting. No clutch. No stalling. Flip of a lever controls speeds, forward, reverse, insures more work output.

**Just like your modern automobile, the modern Eimco makes operations easier, faster and more economical . . . automatically.**

*Investigate the many exclusive advantages of the New Eimco 103 line of Modern Tractors*

**Write for specifications on any of the units in this new, modern series of tractors. Address Dept. AN - 1 — The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah. We'll be glad to demonstrate the unit that best fits your needs right on your own job, upon receipt of a request on your letterhead.**

No other machine can surpass Eimco's rugged custom-built construction. Let us demonstrate the modern Eimco 103 and the famous "Big E", the Eimco 105 Series, to you and your men. You'll agree that here are machines built for the job . . . tailor-made to fill your requirements with rugged long-life quality in every component.

**Want all the facts? For comparative fact sheet,** listing the vital statistics of all leading makes of tractors and front end loaders, write on your letterhead to Dept. AN - 2, P. O. Box 300, Salt Lake City 10, Utah.

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B - 435




Africa *(Continued)*

# fast, firm support for cable or pipe...

## O-B Roof Plate Hooks!

Here's a new type of support for cable or pipe up to 2½ inches in diameter!

No slots, wedges, or parts to fool with or lose. Just a simple, inexpensive, practically indestructible malleable iron hook that you drive between roof plate and roof with a few hammer blows.

No sharp edges, no wobble, no accidental pull-out. Tapered support arm is serrated on top and bottom surfaces so it drives in easily and stays put when pushed or pulled from any direction. When the job is done, hammer it out from the opposite direction and use it again—and again. The high-quality malleable iron takes plenty of pounding without cracking or breaking.

Get your cable or pipe "out from under" foot or wheel this safe, easy, economical way.

Order Catalog Number 22753 today!

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EXPANSION SHELLS AND PLUGS • LINE MATERIALS • SAFETY AND CONTROL EQUIPMENT • ELECTRIC HAULAGE MATERIALS

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UNDERGROUND
OR ON THE
SURFACE
YOU'LL CUT EXPLORATORY COSTS IN HALF WITH THESE DIAMOND CORE DRILLS
SUPER PIONEER
Here's a rugged compact light-weight drill you can take anywhere. The Super Pioneer eliminates guesswork by giving a true core sample to depths of 100' or more. Designed for one-man operation, drills at any angle in all formations. Gasoline-powered drill and pump weigh just 35 lbs. each.
Basic kit includes drill, pump, and accessories. Rods and bits additional.
$885.00
FOB Spokane
SUPER SCOUT
This all-new air-powered one-man drill sets up and tears down in minutes, eliminating lengthy traffic tie-ups. Hand operated hydraulic feed supplies drilling pressure up to 1500 lbs. Anchor column provides drill support at any angle with or without back wall. Drills in any direction or at any angle to depths up to 100' with exceptionally high core recovery. Weighs just 85 lbs.!
Complete unit includes drill, hydraulic feed, anchor column, hoses, 50' of rods, core barrel, starting barrel, collar pipe, tools, and storage box.
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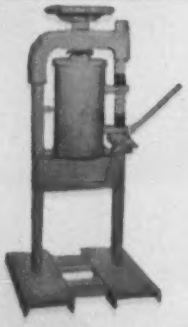


MINIMIZE FILTERING TIME WITH THE BOOTH PRESSURE SAMPLE FILTER

Unlike most pressure sample filters, it does not require the tightening of two screws before applying air pressure, thus making it unexcelled for speed and convenience. It is closed by simply swinging barrel and yoke into place and rotating hand wheel. When open, free access is given to barrel and base. All parts line up automatically. Write today for Bulletin No. 566 giving further information.

40 YEARS OF ORE TREATMENT

THE BOOTH CO., INC., 333 WEST 14TH SO., SALT LAKE CITY, UTAH
MINERALS SEPARATION • RESEARCH • EQUIPMENT • PLANT OPERATION


## Africa *(Continued)*

**Reitfontein Cons.,** in the Germiston area east of Johannesburg, is expanding onto two claims adjoining its northern boundary and on an additional 5.8 claims towards the west.

**Shaft sinking at Western Deep** on the Rand continues to be rapid. From February to March, Western Deep sunk 643 ft to a depth of 3,018 ft on No. 2 main shaft and 479 ft to 2,714 ft on No. 2 ventilation shaft; 767 ft to 4,429 ft at No. 3 ventilation shaft and 509 ft to 3,536 ft on No. 3 main.

**St. Helena** reports values of 626 in. dwt—the best yet from its property in Eastern Transvaal.

**Merriespruit pumped out 30 ft of water** to a level of 1,248 ft below the collar in the first quarter of 1959. At the time of flooding of the mine in Orange Free State in 1957, the water stood at 600 ft below the collar. Pumping has lowered the water table throughout the area.

**Vogelstruisbult,** near Springs on the East Rand, suffered increasing difficulties with a progressive decrease in the amount of stope face available, by lengthening lines of communication, greater dispersal of ore reserve blocks and showed a marked reduction in tonnage treated in 1958.

**Rand Mines** are reported to have committed $364,000 to prospect an area 40 miles northeast of Karoi in Southern Rhodesia. Rand applied for an exclusive prospecting reserve over 500-sq miles of the area. Copper assays are reported at 2.5% and above.

**Anglo American Prospecting Co. (Africa) has acquired options over about 30,000 morgen,** (63,500 acres) 15 miles west of Ventersdorp, a small town in the Western Transvaal.

Anglo American Prospecting has been drilling there for the last eight months, according to Unified Gold and Exploration Co.

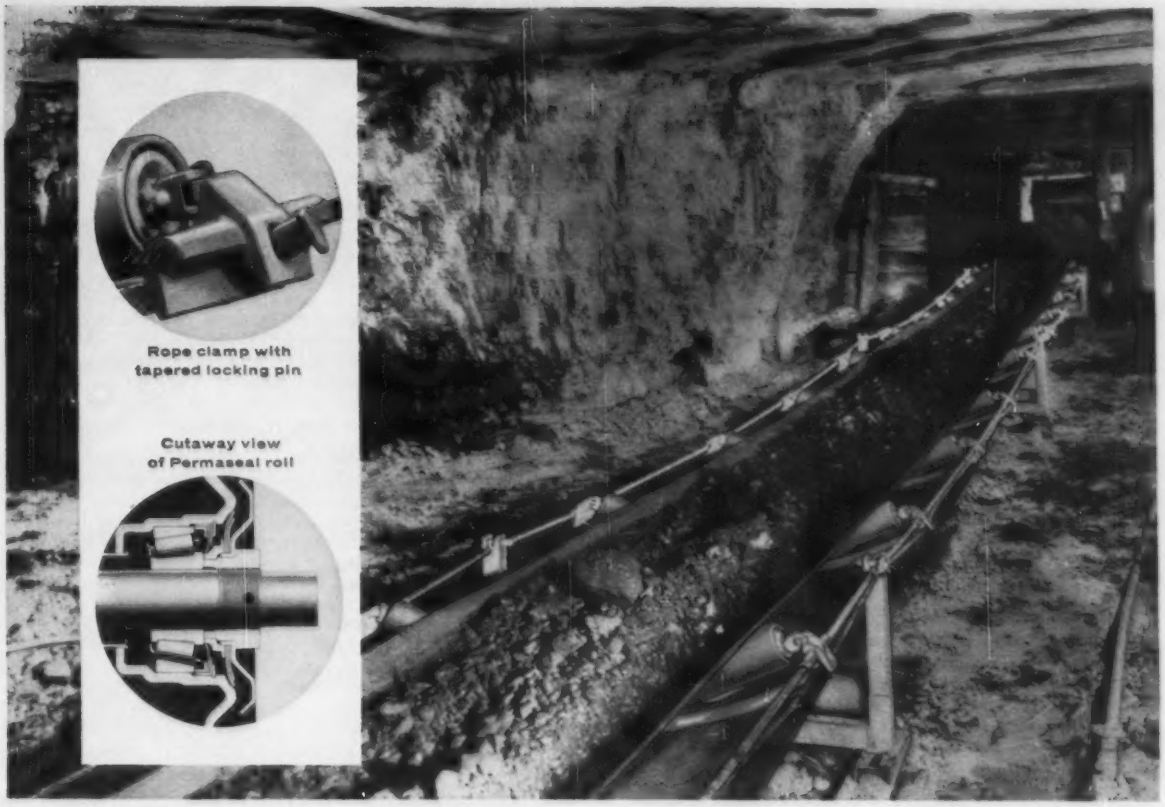
Unified's wholly owned subsidiary, Transvaal Mineral Rights Exploration Company, entered into an agreement with Anglo American Prospecting under which the latter company has taken over its mineral options at Makokskraal, where the ground is situated.

**The possibility of another large new mine** in the Klerksdorp goldfields (Western Transvaal) has emerged from an announcement that Free State Development and Investment Corporation ("Freddies") has decided to drill two boreholes in the area—one jointly with Western Holdings and the other jointly with Rand Mines.

If a mine takes shape in this area it will probably be deep. It may also take in a portion of the Buffelsfontein lease area in the bend of the Vaal River, north of the eastern boundary of the new area, to make possible a compact mining area.

Buffelsfontein has been producing for about a year.

**In Europe starts on p. 148**



Rope clamp with tapered locking pin

Cutaway view of Permaseal roll

# Above and below ground, JEFFREY belt conveyors (wire rope type) have these advantages...

**Low first cost**—Easy and economical to set up with fewer parts; need no belt training idlers; intermediate sections require no cover plates; two parallel wire ropes replace heavy rigid type angles or channel side frames.

**Low operating costs**—Fewer components to handle or transport saves time in extending or retracting. Little or no spillage means less clean-up time.

**Long belt life**—Lasts longer as load impact is absorbed by spring effect of wire ropes when load passes over troughing idlers.

**Permaseal idlers**—Have Timken tapered roller bearings protected by two flexible diaphragm seals. Inner seal retains lubricant. Outer seal keeps out dirt. Prelubricated for years of maintenance-free service.

**Spacing of idlers**—Can be changed easily to suit material or mine conditions.

**Rope clamp for cradle bracket**—Rope clamps with "no loss" tapered locking pins prevent creeping. Cradle brackets and support stands hold ropes parallel. No separate spreader required.

**Versatility**—These conveyors can be used above or below ground to handle coal, salt, gypsum, iron ore, etc.

For more details send for bulletin 948. The Jeffrey Manufacturing Company, 974 North Fourth Street, Columbus 16, Ohio.

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# IN EUROPE

ONE OF THE MOST outstanding developments on the Continent these days concerns the changing attitude of the Spanish government toward foreign investment—one company has been granted permission to invite foreign investment into the fold. From Spain also comes word that an aluminum fabricator will be erected.

## ITALY

**Production of both mercury ore and** mercury metal registered a drop in 1958 compared to 1957.

Breakdown in metric tons follows:

| | 1958 | 1957 |
|---|---|---|
| Ore | 294,210 | 364,718 |
| Metal | 2,004 | 2,154 |
| | (58,142 flasks) | (62,494 flasks) |

## SPAIN

**Spain's strongest mining company, Compania de Minas del Rif S.A.,** has been given a go-ahead by the government to increase its capital two-fold with 45% foreign participation, said an official government spokesman.

The major break-through of foreign capital into Spain's strongest mining company is the first to occur in the line of the mining industry.

Some believed that this is the first of a series of new economic measures that will lift the ban for foreign capital participation in Spain's most needed industries.

Minas del Rif began operating in 1914 in the former Spanish possession of Morocco, was very successful with its rich iron ore mines of Beni uf Ifrur till the newly independent Arab State demanded from the Spanish company "a very heavy toll," the figure was never released for public information.

Now Minas del Rif will expand with foreign capital in a major break-through since the recent Petroleum Law sponsoring foreign capital participation.

**Fuel costs for large central-station atomic power reactors in Spain will probably exceed fuel costs of power plants conventionally fired with coal, gas or oil,** it was admitted by Spain's Junta de Energia Nuclear. Cost will probably range between 1.5 or 2.5 mills per kilowatt-hour.

The salient feature in Spain's nuclear fuel economics at the present moment, probably also far into the future, is the dominant position of the government in determining all major costs, except for imported fuel.

During this period, it was said, the Spanish State will be the major, probably the single, consumer of freshly mined uranium for the reactors. At the present, all uranium stocks are obtained from the plant of Andujar, aside from minor sources. Although the total completion of Andujar was slated for June, the date has been pushed for the late part of the year.

According to Junta de Energia Nuclear the proved reserves of natural uranium in Spain which can be mined and milled are reported to be in excess of 1,500 metric tons of uranium metal. The proved reserves might be doubled in existing producing areas through more intensive development.

**Mrs. Jose Marie Otero Navascus,** president of Spain's Nuclear Energy Board, acting as spokesman for the official Spanish body, stated that an important discovery of radioactive deposits was made in the province of Avila recently.

According to the information released the site of the discovery is the valley of Tormes, in the surroundings of the centuries old town of Avila. The information calls the discovery of great importance.

The report made by the Spanish official wound up stating that the site of the discovery will mark the future emplacement of a dual purpose reactor.

**An atomic official said that Spanish mines will supply the country's uranium needs from June, 1960 on.**

This forecast was made by an official of the Junta de Energia Nuclear, Spain's official atomic energy commission.

Recently the Junta de Energia Nuclear has been encouraging prospecting for uranium fields in this country. Nevertheless, till now it has bought some of its supply abroad, but with atomic energy in a growing trend, uranium production must be increased if Spain wants to curb dollar spending.

Although Spain is estimated to have enough raw material resources, it is becoming increasingly apparent that if prospecting is not expanded demand will outbid supply in the near future when today's reactor projects are in operation.

It is believed that, to further uranium exploration, the Spanish government will revise Spain's mining laws to entice private enterprise prospecting.

According to the present Spanish mining law all products must be sold to the Junta de Energia Nuclear at a fixed price. Private capital complains it is below realistic level.

**An official spokesman announced government plans to build a major aluminum plant in the northwestern area of Spain, probably in the port of Vigo.**

According to the released information the plant will have an initial annual capacity of 4,000 tons of sheet and foil, and 2,000 tons of wire and cable for electrical transmission lines. Its products will also include roofing sheet and siding, the announcement added.

Inside information checked the data released by the government and added that Canadian companies had showed interest in the plant.

## AUSTRIA

**In comparison with the Austrian mining production in the first quarter of 1958,** the mining output in the first three months of 1959 showed no significant decreases. The January-March production in 1959 included 779,164 metric tons of iron ore, as against 792,379 metric tons in the similar 1958 term; 49,559 metric tons of lead and zinc ores (1958: 44,852); 40,443 metric tons of copper ore (1958: 41,213); 266,256 metric tons of raw magnesite (1958:316.690); 2,427 metric tons of bauxite; 11,330 metric tons of talc and talc-slate; 51,343 metric tons of raw kaolin; and 15,636 metric tons of clay and bentonite.

The production of graphite increased from 5,055 tons in the first quarter of 1958 to 6,512 tons in the 1959 term, while the output of tungsten ore rose from a volume of 1,437 metric tons to 1,847 metric tons over the same period. (See June, p. 400 for 1958 data).

**West German interest in Austria's recently-discovered highly-pure quartz** triggered plans for fastest possible exploitations of the deposits near Kobersdorf, Burgenland province. The West German interest in quartz lies in ferrosilicon production and the fact that West Germany does not possess sufficient amounts of high-purity material itself.

The quartz deposit is carefully estimated to contain 65,000 metric tons. The deposits come in pods of up to 10 meters thickness and 200 meters length. The silica content is between 99.27% and 99.47%, the iron oxide content 0.025% and 0.28%. The aluminum oxide content—very disturbing during the ferrosilicon process—is only 0.024% to 0.25%.

## GERMANY

**Despite booming conditions, German steel men are still eyeing lower prices for French-produced steel with evident distrust.** They feel that the bottom will drop right out of their market should the threatened U.S. steel strike fail to materialize. To ward off the danger of lost or cancelled orders, the powerful Association of German Iron and Steel Industries has recently brought pressure to bear on the European Higher Authority and has requested this body to force French steel mills to raise the price of steel exported to other Common Market countries by 4%, and/or to increase the price of French basic Bessemer steel by 2%.

The strike threat by U.S. steel men is having repercussions here in the form of a minor steel boom. During April this year, German mills booked orders for 1.5-million tons of rolling-mill products. These bookings are well above the average monthly figure registered in the boom year of 1957. Presently, most German mills are working at full employment, the only backlaggers being the plate mills.

In April of this year German rolling mills produced a total of 1.42-million tons of rolled products. This figure is roughly 12% higher than the average monthly figure in 1958.

(*Continued on p. 150*)

# *Yieldable Arch can be installed as the drift is being driven*

These workmen illustrate another special advantage of Bethlehem's yieldable mine roof support: they're installing Yieldable Arch sets right next to the breast of the drift. That means the overburden is brought under immediate permanent control, without the time and expense of temporary roof support.

And we do mean *control*, for as soon as the surrounding forces bear down too hard, the Yieldable Arch will give a little instead of collapsing. This allows the overburden to settle gradually until it forms a natural pressure arch around the mine opening.

The Yieldable Arch works on a sliding joint principle, with friction the determining factor. Nestable segments of U-shaped rolled steel are overlapped at the ends, and these joints are secured with heavy U-bolt clamps which are drawn up tightly enough to hold fast under normal loads. Excessive pressure, however, overcomes the friction in the joint, causing the arch to yield. The load is thus relieved and the structural integrity of the arch is maintained.

Horizontal braces or struts tie one arch set to the succeeding one to provide lateral stability to the structure. Blocking and packing between the lagging and roof are recommended to distribute loads evenly.

Bethlehem engineers have acquired considerable experience in the use, installation and maintenance of Yieldable Arches, and would be glad to apply their experience to your mine-roof problems. A visit to your workings would, of course, be helpful and we would welcome the opportunity whenever it is convenient for you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

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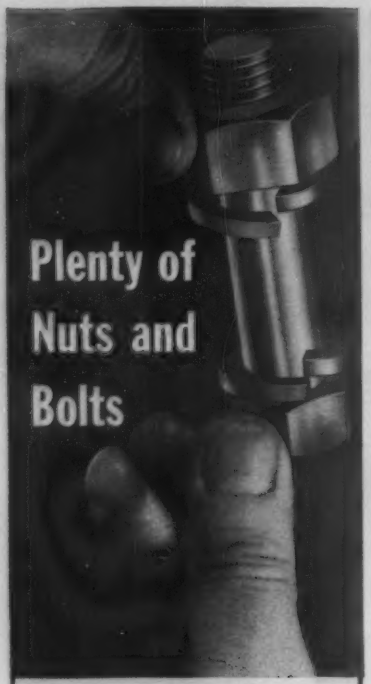


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Europe *(Continued)*

## POLAND

**Poland's star mining project, the Tarnobrzeg sulphur mining center, is to receive 24,500,000 Zloty ($6,125,000) additional investment funds** this year in order to speed up the mechanization of both mining and processesing stages. TRYBUNA LUDU (Warsaw's most important daily) reports in a follow-up of an earlier report in E&MJ June, p. 402.

The additional funds will be allocated through the Chemical, Construction, and Transport Ministries. The chemical industry plans to build necessary amenities, the Transport Ministry will build a bridge over Vistula River to connect the mining site to the West-Polish railroad network. The construction industry plans to create a new state building enterprise to exclusively serve the Tarnobrzeg mining and processing site.

Estimated to contain 110-million metric tons of pure sulphur, the Tarnobrzeg deposits were discovered in late 1953. The deposit was immediately tagged as COM-ECON's major sulphur supply center, and funds were raised on international level. (East German, Czech). In return, Poland is to ship 120,000 metric tons of sulphur to Czechoslovakia after 1960, 90,000 metric tons to Hungary, and 100,000 metric tons to East Germany. Deliveries of sulphur to Czechoslovakia and to East Germany are bound to increase by 130,000 metric tons/year and 220,000 metric tons/year, respectively after the full capacity of Tarnobrzeg has been reached.

Poland questions — through GOSPODARKA PLANOWA (the Planning Office's own periodical)—the USSR's ability to continue delivery of sulphur to the Socialist countries, owing to domestic requirements. Poland is thus believed to take over all the present Soviet sulphur deliveries to the other East-Block countries.

Furthermore, Poland sees actual sales chances in the Western part of Europe, notably in the Scandinavian countries. The market is held small, however, not exceeding 40,000 metric tons per annum. More interesting to Poland is, for example, Great Britain, with a present annual demand of 335,000 metric tons, believed to rise to 600,000 metric tons in 1965. "Seasonal export possibilities for Polish sulphur may likewise develop on the remaining markets dominated at present by American, Mexican, French, and Italian sulphur," the magazine states, adding that "it is desirable and also possible to export Polish sulphur to capitalist markets before 1965 as this will inaugurate large exports of Polish sulphur to these markets after 1965."

## TURKEY

**Anglo-Turkish Development Ltd. plans to begin development of four properties in Turkey following favorable reports** by Dr. Chris Riley, consulting geologist, who is making arrangements to incorporate in Turkey so that the work can proceed. Three of the properties, those entailing fluorspar, mercury and copper are privately-owned. A borax property, is owned by the Turkish government and negotiations are necessary before work can go ahead. The fluorspar is a raw property, no work having been done on it. It has good width, grade and tonnage potential, according to Dr. Riley. Douglas Mitten, Vancouver, is president of Anglo-Turkish.

# IN ASIA

## INDIA

**An official** of the Indian Commerce & Industry Ministry is in the U.S., to enter into final price agreements about a proposed Indo-U.S. barter deal, initiated in Washington in March. It is now known that against 450,000 tons of U.S. wheat, India will send 150,000 tons of manganese ore (42%), 25,000 tons of manganese ore (46 to 48%) and about 75,000 tons of ferromanganese. India in 1958 exported a total of 2,018,000 tons of ore.

**Another Indo-U.S. development** in this sector is the entry with know-how and

*(Continued on p. 152)*

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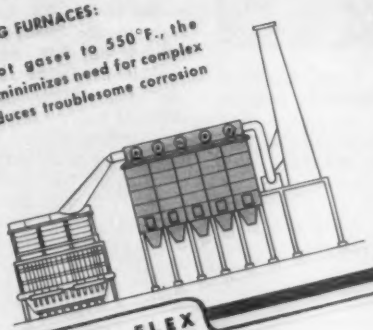

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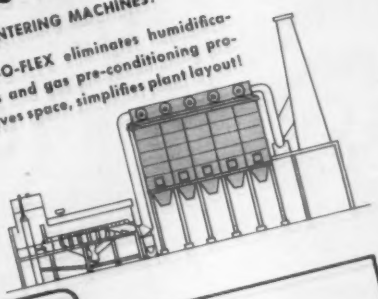
**The THERM-O-FLEX eliminates humidification towers and gas pre-conditioning processes...saves space, simplifies plant layout!**



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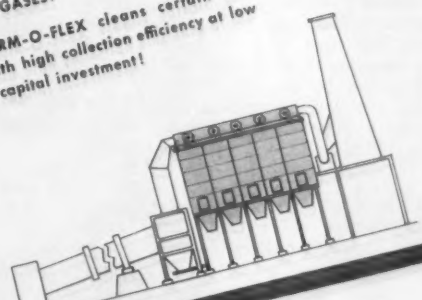

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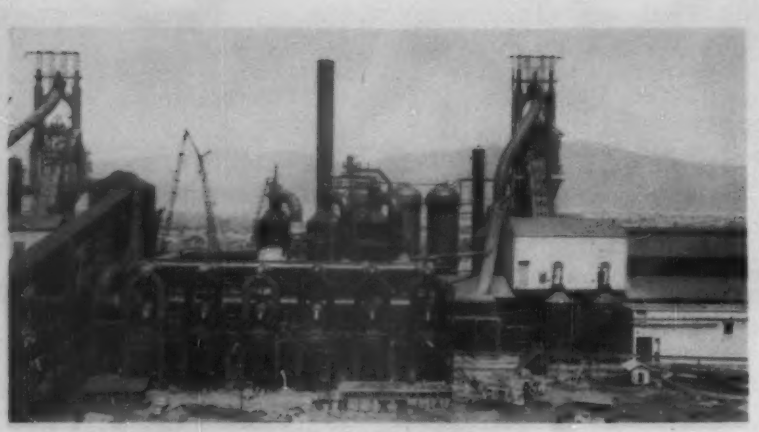

**THE TATA SKYLINE** has a sixth blast furnace, installed by Kaiser Engineers Overseas Corp. as part of the recently completed two-million ton expansion program at Jamshedpur, India. Tata Iron & Steel Co. Ltd. is the largest private steel firm in India. Its present capacity is twice that of the planned capacity for each of the three new Indian government-owned plants being built—one by Russia, one by a West German combine and the other by a British consortium.

## Tata Iron & Steel Completes Expansion

ALL BUT A FEW of the U.S. technicians who were employed on the two-million ton expansion program of India's largest private steel company now are on their way home. Kaiser Engineers Overseas Corp. has turned the job over to its client, the Tata Iron & Steel Co., Ltd., Jamshedpur, India.

With the expansion program now completed, Tata's Jamshedpur Works has the capacity to produce 2-million ingot tons of steel a year, fully one-third of India's proposed capacity under the current Second Five-Year-Plan.

The Tata expansion represented the largest such program ever attempted by an Indian firm, and one of the largest single contracts ever awarded a U.S. engineer-constructor.

TMP began in December of 1955 with the signing of a contract between Tata and Kaiser Engineers. Work in Jamshedpur included construction of both new and rebuilt coke ovens; a blast furnace; an ore crushing, screening and sintering plant; a steel melting shop; a blooming mill; a sheet bar and billet mill; a medium and light structural mill; and additional power, transportation, water, fuel, and gas cleaning systems.

The first major facility, the calcining plant, was placed in operation in August of 1957. The blooming mill rolled its first ingot in August of 1958. A climactic event of TMP was official blowing-in and dedication of the blast furnace in October of that year. All of the iron-making, steel producing and finishing facilities were placed in operation by the end of 1958.

Special considerations of the program were the necessity to cause minimum interference with existing steel production, purchase and shipment of equipment on a world-wide basis, the unexpected four-mouth closure of the Suez Canal, and Indian labor unrest.

Most of the major equipment could not be obtained in India, so Kaiser had to purchase and expedite material from the U.S., England, Germany and Japan. Some 100,000 tons of such equipment—as well as another 80,000 tons of Tata operating material — were brought through the congested Port of Calcutta on its way to the jobsite.

At the height of construction, 100 Kaiser supervisors lived with their families in Jamshedpur. The Indian work force on TMP totalled 20,000. There also were more than 100 subcontractor personnel from other countries.

## INDIA *(Continued)*

capital of the K. A. Export Corp. which has assisted the Bombay-based Khandelwal Ferro Alloys Ltd. plan to set up a ferromanganese plant near Nagpur in Bombay state. The plant, which is slated to go into production in early 1960 will have two furnaces to produce 30,000 tons annually. The entire output of this plant for a ten year period will be sold to the Continental Ore Corp. of New York.

**Khandelwal Ltd.** has agreed to negotiate deferred payment terms for plant and machinery with Electrokemisk A/S of Oslo, Norway.

## JAPAN

**The Ministry of International Trade** and Industry (MITI) has fixed a new price of domestically produced electrolytic copper, effective Apr. 11.

The local price has been $806 per long ton. The new price will range between $778 and $945, according to world prices —particularly those in the U.S. The export price—mostly electrolytic copper in product form—will be $30 under the domestic. price.

**The Japanese government has approved** a joint firm tie-up between Furukawa Denko and Alcoa. The new firm will be known as Furukawa Aluminum or Furalco, owned 67% by Furukawa Denko and 33% by Alcoa for a total capitalization of $444,444.

Furalco plans to produce 12,480 tons of rolled aluminum this year and will raise production to 40,080 by 1973.

## IN THE PHILIPPINES

**Samar Mining Co. has found a new ore-body in the Sibuguey project in Zamboanga del Sur, which is now being evaluated.** Development at Sibuguey has been slower than anticipated because of heavy rains that hampered road construction as well as shortage of foreign exchange for purchase of equipment and supplies for construction of pier and mine facilities. Nevertheless work is going on at top speed to open up the big iron ore deposit. Over $500,000 worth of heavy road building equipment is gaining access to the deposit.

The road surfacing work from Sibuguey to the mine site will cover 18 kilometers and the whole 42 kilometer road will be completely gravel-surfaced by the end of the year. The new iron mine is reported to have blocked out seven-million tons of ore with an even larger potential, making it one of the biggest and richest iron properties in the Far East.

The property is controlled by Elizalde interests who also operate the Masara gold mine in Davao. The company has asked the National Economic Council to approve a qualified barter arrangement under which the firm would ship iron ore to Japan and receive initially machinery for a cold roll mill.

**Acoje Mining Co.** has completed the sale of a substantial tonnage of chromite concentrates and is currently considering the feasibility of establishing a ferrochrome plant in the Philippines.

**Atlas Consolidated Mining Co. milled 377,000 tons in April,** averaging 0.65% copper, estimated to contain 3,831,000 lb. of copper. (See E&MJ June, p. 392 for details of March production.). Shipments of over 4-million lb to Japan were valued at $1,190,000 during the month. In addition the mine shipped 800 tons of pyrite to the National Power Co.

From its Mati iron mine in Davao the company shipped 20,100 tons of iron ore and sinter to Japanese steel mills.

**Lepanto Consolidated had a near record production in April,** milling 37,300 tons of copper-gold ore, estimated to contain 2,580,000 lb of copper and 4,700 oz of gold. Copper recovery was 96.4% and gold 77.8%. The property was recently visited by a top official of American Smelting & Refining Co., who has a contract to purchase the concentrates. The gold is returned to the company, where

*(Continued on p. 154)*

# "when I grow up I'm going to run one of those"

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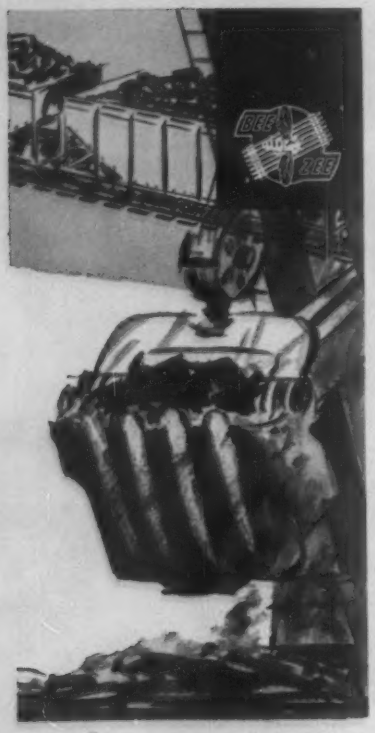

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## Philippines *(Continued)*

it is sold on the open market for the current 140 pesos per oz (earlier details appeared in E&MJ June, p. 392).

**Palawan Quicksilver Mines** sold about $730,000 worth of mercury in 1958. The company now has three kilns in operation, able to treat 75,000 tons of ore per year and producing 350 flasks monthly.

**Philex Mining Co., operating a copper property in the Baguio area,** expects to be milling 2,000 tpd in June from underground work. If barter privileges are available, production will be increased. Production has heretofore come from the open pit, where a relatively small medium-grade high-oxide orebody is exposed. Henry A. Brimo is president. In April 43,700 tons were milled, producing 477,490 lb of copper and 1,200 oz of gold, with a combined value of over $213,000. Lack of water during the month hampered the exploration program, but a new tailings thickener will be installed for recovery of mill water. Philex now ranks fourth in copper production in the Philippines.

**Liberty Chromite Mining Co.** has shipped another 2,000 tons of chromite ore to Europe. Negotiations are under way for further shipments to U.S.

**The following are the production figures** for the Surigao Consolidated Mining Co., Inc. (also see E&MJ June, p. 390) mines at Siana, Mainit, Surigao, for the month of May, 1959: Tonnage milled, 6,825 tons; Gold recovered, 1,582 oz; Silver recovered, 1,971 oz; and Lead recovered, 45,000 lb. Based on average market price, the total value of above production amounted to P$248,096.50.

# IN AUSTRALIA

OFFICIAL FIGURES show that **Australia's** mined gold production in 1958 was 1,102,731 fine oz, a slight increase on the 1957 figure of 1,083,941. The result was the second-best in the postwar period, the peak having been achieved in 1954 with a figure of 1,117,742 fine oz.

Refinery production of newly-won gold of Australian origin in 1958 was 1,069,774 fine oz, a slight drop on the record postwar figure of 1,078,419 fine oz achieved in 1957.

Western Australian output accounts for 79.4% of the Australian total and Queensland's share is 6.8%.

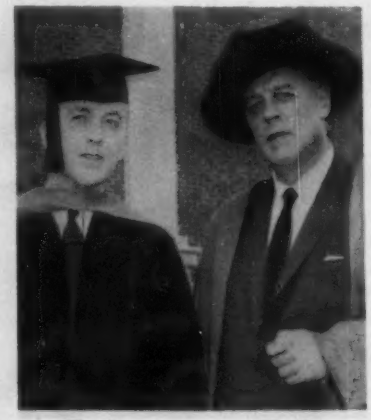
**Queensland Mining Ltd. has been registered** to develop estimated 1-million tons of uranium oxide ore in two leases near Mt. Isa, west Queensland copper-lead-zinc center not far from established Mary Kathleen uranium mine and refinery. Company representative said development of leases, currently being checked by Queensland State Bureau of Mineral Resources, would depend on success in ore treatment and on obtaining satisfactory contract for disposal of uranium oxide.

## Personals *(Cont. from p. 94)*

**Jay Stoel** is the new president of the Mojave chapter of the Western Mining Council. Other officers of the recently reactivated chapter are **Dr. E. W. Kinnicutt** of Cache Creek, vice president, and **Mrs. Kinnicutt, secretary-treasurer.**

Highlight of a report on a WMC meeting recently at Mariposa concerned the retirement of **J. B. Hall** of Santa Cruz as WMC president. His post has been filled by **Stephen Ridgely** of San Jose.

**Lee R. Stoiser** is now in Seoul, Republic of South Korea, as a mining engineer with the Paul Weir Co. of Chicago, examining mineral deposits for the Korean government under the ICA aid program to that country.



**Wearly** **Hovde**

**W. L. Wearly,** president of Joy Mfg. Co., Pittsburgh, was awarded an honorary doctor of engineering degree by Purdue University, Lafayette, Indiana. **Dr. Frederick L. Hovde,** Purdue president, conferred the degree on Wearly, who graduated from Purdue with a BS degree in electrical engineering in 1937. He joined Joy as a design engineer and rose through the ranks to become president in 1957.

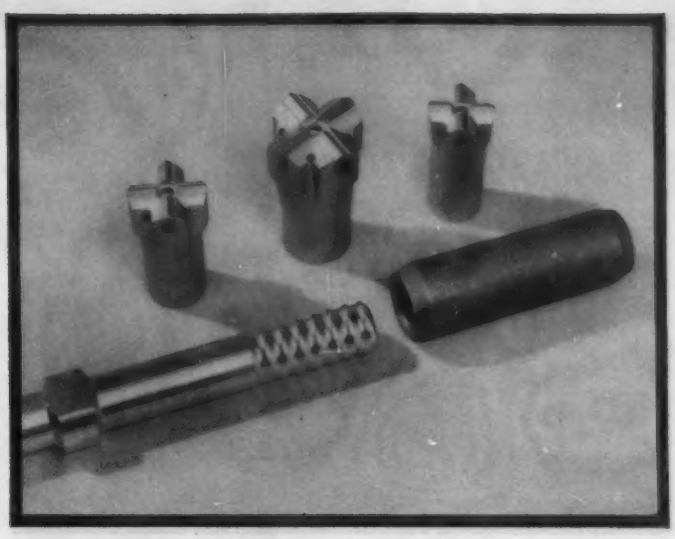
**Alfred W. Knight** was elected president of the Western Precipitation Corp. He succeeds **Walter A. Schmidt,** who remains as board chairman.

Knight joined the company in 1924 and was elected vice president in 1938. In 1956, he was made executive vice president and general manager. Mr. Schmidt, the outgoing president, had held that position since 1911.

**James D. Moore,** former production manager, has been named pilot plant manager at Vitro Uranium Corp.'s mill at Salt Lake City.

From 1948 to 1951, Moore served as a petroleum technologist with the Sinclair Refining Co. He joined Vitro at Salt Lake City in 1951 as a chemical engineer. He became senior chemical engineer in 1952, chief process engineer in 1953, and production manager in 1958.

**James A. Noble** has resigned his position of professor of economic geology at the



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**Names of men quoted available on request*

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Part 2. Petroleum and Natural Gas
6: Part 1. Mine Financing
Part 2. Bank Loans on Oil and Gas Production
7: Part 1. Marketing of Nonferrous Metals and Ores
Part 2. Marketing of Industrial Minerals
Part 3A. Marketing of Iron Ore
Part 3B. Marketing of Pig Iron
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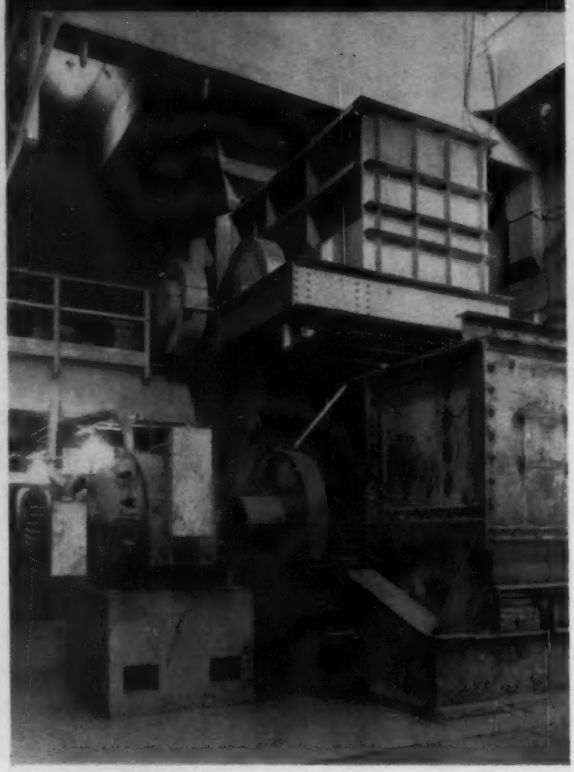

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*Bottom-Dumps carry 13, 17 and 25 cu. yds. struck . . . special coal hauler trailers have capacities of 25, 40 and 51 tons. Full length, unobstructed door opening make these "Eucs" ideal for dumping free-flowing material into drive-over hoppers.*

*The TC-12 Crawler has 2 engines and independent track drive . . . 425 net h.p. . . . full power shift . . . top speed of 7.8 mph. This "Euc" tractor has unequalled work-ability for heavy dozing, ripping and similar work in mines and quarries.*

*This "Twin" Scraper has 2 engines with Torqmatic Drive . . . all wheel drive permits self-loading . . . struck capacity is 24 cu. yds. There are six other Euclid Scrapers, overhung engine and six wheel types, with struck capacities ranging from 7 to 24 yds.—9 to 32 yds. heaped.*

GM GENERAL MOTORS EUCLID

# EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

## Wherever Ore Moves, SCOOT-CRETE
## Ore Carriers Move It • FASTER • EASIER • AT LOWER COST

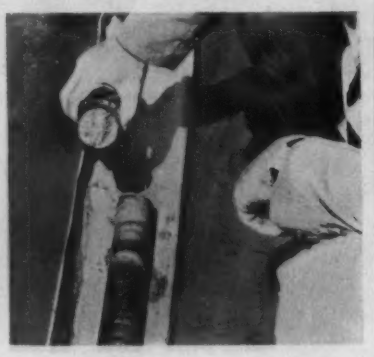
SCOOT-CRETE CD-4, shown being loaded in mine, will carry up to 15 tons payload. Model CD-3N has 5-ton payload. Note driver's side-mounted position for maximum vision and efficiency, forward and rear.

**On the Western Slopes, on the Colorado Plateau, SCOOT-CRETE does the job. No rails needed, no ties, no cars, no independent power source. Diesel-powered for operation inside the mine, SCOOT-CRETE carriers are rugged for around-the-clock service, carry up to 15 tons at speeds to 15 mph, climb grades up to 18%. All CD models approved by U.S. Bureau of Mines for underground mining.**

Units available from 3,000 lb. to 15 ton capacity. Write for specifications and literature. See your Dealer.

**GETMAN BROTHERS** SOUTH HAVEN 2, MICHIGAN

## 98% CORE RECOVERY IN UNCONSOLIDATED SAND & SILTSTONE!



In the Gas Hills Area of Wyoming, loose sand and siltstone occur in the ore-bearing zone with core recovery averaging about 65%. In our determination to give only the very best, Sprague & Henwood used the "frozen" core technique by which the recovery was increased to 98%.

The value of ore reserves can best be determined by a high percentage of core recovery. Throughout Sprague & Henwood's more than 75 years of service to the industry, we have consistently made every effort to furnish the highest percentage of core possible. Our new contract brochure illustrates our complete drilling service; we would be glad to send you a copy upon request.

If you are planning a program of diamond drilling, from either the surface or from underground, contact Sprague & Henwood, Inc., at our home office in Scranton, Pennsylvania, or at the branch nearest you.

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S&H

New York—Philadelphia—Atlanta—Pittsburgh—Grand Junction, Colo.—Buchans, Nfld.


## Personals *(Continued)*

California Institute of Technology. He will continue to live in California and carry on consulting work for a number of companies having interests in California, British Columbia, and Alaska.

**Ward E. Balmer** has been named director of public relations for the Utah Copper Div. of Kennecott Copper Corp.

The former assistant to the director of industrial and public relations of KCC at New York City, succeeds **Nelson W. Aldrich,** who has opened his own public relations and management consultant firm in Salt Lake City.

Balmer joined the public relations department of the Chino Mines Div. at Hurley, N.M. in 1948.

**J. R. Stewart** has been named comptroller of Quebec Cartier Mining Co., according to **L. J. Severson,** president of the firm.

Mr. Stewart joined U.S. Steel Corp. in 1943 and has served in various positions at several steel producing plants in the U.S. Prior to his appointment with Quebec Cartier Mining Co., Stewart was comptroller of U.S. Steel Products Div., N.Y.C.

**Charles E. Bartlett,** manager of Reynolds Metals Co. operation in British Guiana, and **Clark L. Wilson,** vice president and manager of operations, New Park Mining Co., Salt Lake City, were honored by College of Mines & Minerals Industries of the University of Utah at June commencement.

Mr. Bartlett, a graduate of the class of 1927, received a professional degree in metallurgical engineering and Mr. Wilson, class of 1936, received a professional degree in geological engineering.

**Roscoe E. Bell,** Salt Lake City, co-ordinator in Utah, Arizona, Idaho and Nevada for the Bureau of Land Management of the U.S. Dept. of Interior, has been named director of the division of lands in the Alaska Dept. of Natural Resources, Anchorage, Alaska.

**Carroll E. Dobbin,** 68, geologist with the USGS, retired May 31 after 41 years government service.

Dobbin was appointed assistant geologist with the USGS in 1918 and became regional geologist in the Conservation division at Denver in 1928.

He is a member of 18 scientific, professional and fraternal societies, and is a former president of the American Assn. of Petroleum Geologists, the Colorado Engineering Council and the Colorado Society of Engineers.

**Robert C. Sullivan,** former secretary of the Kennecott Copper Corp. and its associate counsel in New York City, has been named to the newly-created post of general counsel of western mining divisions at Salt Lake City.

**C. D. Michaelson,** general manager of western divisions, said that Sullivan would function as a staff advisor on legal matters concerning Kennecott's four operating properties in Utah, Arizona, New Mexico and Nevada.

# NOW FROM FORD
# America's lowest-priced 4-wheel drive pickups
# *Six or V-8!*

**New Ford F-100** 4-wheel drive Styleside pickup handles heavy loads and makes its own road.

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Go *Ford*-ward for 4-wheel drive performance at big Ford savings. New Ford 4 x 4 Pickups have the power and traction to go most anywhere. They're factory-engineered from the ground up for extra stamina, and all Ford-built with your choice of economical Short Stroke power—Six or V-8.

There's new versatility too, with two power take-off points in the transfer case to drive winches, saws, diggers, or other equipment. And there's new driving ease. You shift smoothly between 2- and 4-wheel direct drives while moving. Ford's *driverized* cab provides new riding comfort and modern styling.

Ford 4-wheel drive trucks are available in ½- and ¾-ton pickups, chassis-cabs and ¾-ton stake models. See your Ford Dealer . . . and save hundreds of dollars on America's lowest-priced 4 x 4's with Six or V-8 engine!

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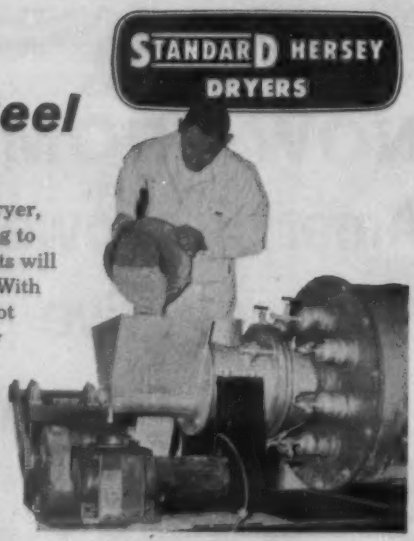
**LESS TO OWN . . . LESS TO RUN . . . LAST LONGER, TOO!**

# Test Dry at Standard Steel




Whether your plans include a dryer, cooler or kiln, it's smart planning to know in advance what the results will be under controlled conditions. With one of the Standard-Hersey "pilot plants" in Standard's completely staffed laboratories you can predict the performance of any rotary equipment. Learn in advance the results to be expected . . . you'll save money by this type of investigation.

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MASTER MECHANICS CORNER:

**Dick Ground**
Master Mechanic for Austin Paving Co., Dallas, Texas, in charge of repairs for over 100 units of construction equipment

**"I've used other make parts on engine overhauls and they did not hold up and wear as long as genuine Cat parts. My feeling is, if you buy substitute parts, you soon have a substitute machine."**

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.


## Personals *(Continued)*

**William H. Hays,** who spent two decades in the coal mines of Ala., Ky., and Okla., and eight years in the potash mines near Carlsbad, N.M., has been appointed N.M. state mine inspector.

**C. H. Creasser** has been appointed vice president in charge of manufacturing for the Walworth Co. According to Walworth president, **John C. Wallace,** Creasser will be responsible for the activities of the firm's four plants—Braintree, Mass., East St. Louis, Ill., Kewanee, Ill., and Greensburg, Penna.

The American Iron Ore Association at its annual meeting in Cleveland re-elected the following for the coming year:

**Herbert C. Jackson,** associate managing partner Pickands Mather & Co., chairman of the board of directors; **Walter A. Sterling,** chairman and president, Cleveland-Cliffs Iron Co., chairman of the executive committee; and **Hugo E. Johnson,** president.

Three new directors, **C. H. Dewey,** Republic Steel Corp., **C. B. Jacobs,** Inland Steel Co. and **R. Q. Archibald,** North Range Mining Co., were elected. All other officers and directors were re-elected.

**Edward I. Renouard,** Butte, Mont., has been elected vice president in charge of western operations of the Anaconda Co.

Renouard had been a shift boss, sampler, safety inspector, assistant mine foreman, foreman, assistant general superintendent of mines. He became general superintendent of mines in 1951, a position he held until elevated to manager of mines the following year.

**Daniel J. Herts** has been named assistant manager of metal sales by the United States Smelting, Refining & Mining Co., according to G. H. LeFevre, vice president and manager of metal sales.

Herts was a member of the sales department for many years. He will assume the duties of **Neill R. Taylor** who recently retired, and will be located at the company's metal sales department, New York City.

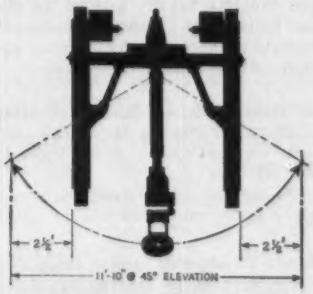
**M. J. (Mike) Nelson,** assistant treasurer and assistant secretary of the Wah Chang Corp., New York, has announced his resignation after 17 years with the company. Mr. Nelson's latest position was assistant to **T. P. Moran,** executive vice president.

**Prof. Jack Hough,** University of Illinois geologist, will be 1959 recipient of the Geological Society of America's Kirk Bryan Award, **H. R. Aldrich,** secretary, has announced.

The award is presented annually "for the paper of greatest distinction advancing the science of geomorphology or related field." Hough was selected for his "Geology of the Great Lakes", 1958 publication of the University of Illinois Press.

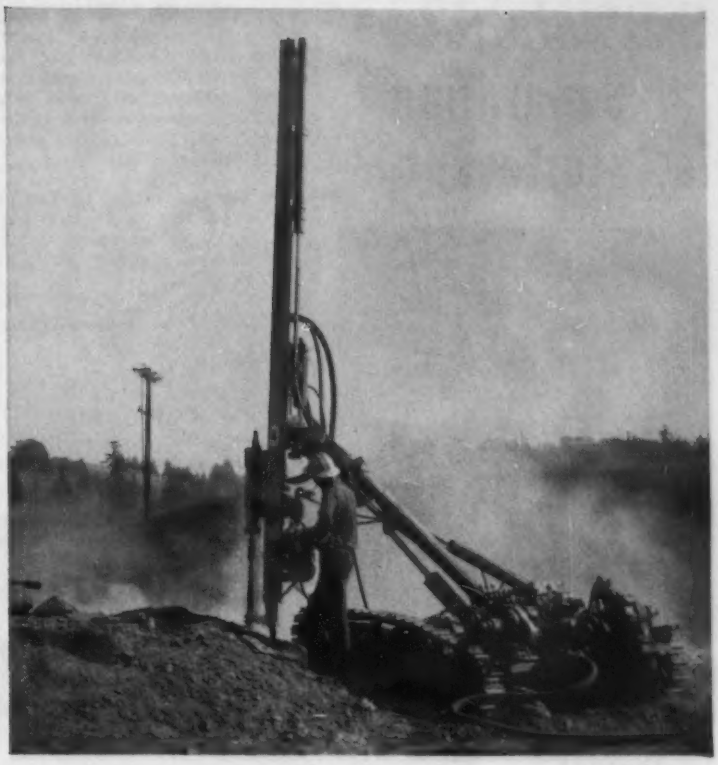
Prof. Hough is editor of the JOURNAL OF SEDIMENTARY PETROLOGY and fellow

**MORE SWING**




**...MORE REACH**

**...MORE FOOTAGE**



# with Gardner-Denver Swing-Boom "Air-Trac"®

TIME TO TALK TIME-SAVING

Gardner-Denver believes there's no substitute for men—it has been our philosophy of growth for 100 years. Your Gardner-Denver construction equipment specialist has helped many uncover ways to speed the pace . . . lower drilling costs. He's a good man to know. Get in touch with him soon.

**Swings 11'10" . . . 2½' over both tracks** Now drill more hole from one position . . . drill over a ledge from either side. Feed swings 11'10" at 45° elevation . . . moves to 2½' outside of each track with balanced stability.

**Reaches to 9'6" height—for horizontal drilling** Get better spacing of horizontal holes . . . reach to 9'6" for high breast holes.

**Moves quickly . . . safely** "Air Trac" is self-equalizing, self-stabilizing, with hydraulic track oscillation. Moves easily, safely over roughest terrain. Designed with an unusually low center of gravity for maximum stability. Long tracks and powerful crawler motors provide plenty of traction. "Air Trac" will pull its own compressor. Tracks available with rubber or steel pads.

**Saves time . . . steps** All controls conveniently located. Drilling and positioning controls grouped at the front of rig to save steps, setup and drilling time.

**Pulls tight steel** Powerful Gardner-Denver 5-cylinder radial air motor enables your driller to put the right pressure on the bit in all drilling situations . . . provides necessary pulling power to bring tight steel out of the hole.

**Maintains hole alignment** Easily handles in-line drilling . . . drilling in fitchery or fractured formations. Creep-free hydraulic boom keeps drill in position . . . track locks keep rig firmly in place in difficult drilling spots.

**Drills fast, clean hole** Gardner-Denver's line of powerful rock drills is most complete—six hard-hitting models to choose from.

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# In Cement and Aggregates the Word for Air Separation is "Sturtevant"

## In cement . . .

*Sturtevant Air Separators make possible highly efficient closed-circuit systems.* Large circulating loads increase output, eliminate overgrinding. Ball and lining life lengthens, power costs are lowered. Top quality cement results from precise control of finenesses. Standard 16 ft. Sturtevants deliver raw fines up to 70 tph, finished fines up to 260 bph.

## In aggregates . . .

*Sturtevant Air Separators classify sand without water, clean sand by de-dusting it.* Pre-classification by air can also increase screening production by removing screen-blinding fines. In blending operations, Sturtevants select desired fines from grinder throughput. This graded product is then used to overcome fineness modulus deficiencies.

*Send for Air Separator Bulletin No. 087.*

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MILL COMPANY
101 Clayton St., Boston, Mass.

Crushers • Grinders • Micron-Grinders • Separators
Blenders • Granulators • Conveyors • Elevators


## Personals *(Continued)*

of the Geological Society of America and American Association for the Advancement of Science.

**Keith O'Donnell,** assistant manager of Sedren S.A. (subsidiary of Consolidated Halliwell of Canada), was presented with the Haitian government decoration "Ordre National du Travail" chevalier class, at a ceremony held at Gonaives on May 18. O'Donnell is a member of the AIME and CIMM.

**L. S. Breckon,** former head of exploration in western U. S. for Kennecott Copper Corp., has retired as chief of land division for Bear Creek Mining Co., KCC's domestic exploration subsidiary.

Breckon plans to be a hard rock mining consultant.

## OBITUARIES

**F. Worthen Bradley,** 55, president of Bradley Mining Co., San Francisco, died June 1. He was president of the California Chapter of the American Mining Congress. He was also a member of the Mining & Metallurgical Society of America and the AIME.

Bradley

Bradley received his BS from the University of California in 1926. In 1933 he became president of Bradley Mining Co.

In 1944, Bradley and R. G. Hall authored "Concurrent Firing at the Sulphur Bank and Reed Quicksilver Plants."

**John Cromwell Lincoln,** 93-year-old industrialist, economist, and philanthropist died May 24 at Phoenix.

Lincoln was president of the Bagdad Copper Co., and founder and still honorary chairman of Cleveland's Lincoln Electric Co.

He graduate from Ohio State University in 1888 as an electrical engineer, and began his business career in that state.

Lincoln was the inventor of the electric arc-welding process.

He came to Phoenix in 1931, and spent most of his time there. He was one of the builders of Phoenix's Camelback Inn and was president of the operating company.

Lincoln was a member of the American Welding Society and of the American Institute of Electrical Engineers, and he held an honorary doctorate of science from Arizona State University.

**A. Todd Davis,** 46, director of industrial relations for Nevada Mines Div., Kennecott Copper Corp., died May 19 at McGill, Nev.

At the time of his death, he was opening negotiations on new labor contracts.

**James P. Ahearn,** former Cripple Creek resident, died in Denver on April 18. Ahearn was a diamond-driller with headquarters in Denver, and contracted in many parts of the U.S., Mexico, and Russia.

**Chester H. Steele,** 65, vice president in charge of western operations for the Anaconda Co., died May 19 at Butte, Mont.

Steele

Mr. Steele graduated from the Montana School of Mines in 1916 and began to work for Anaconda that same year as a geologist. He headed the Butte geological department from 1948 until 1952 when he was made general manager of western operations.

He had been president of the Montana Society of Engineers and chairman of the Montana section of the AIME. He was also a member of the Society of Economic Geologists.

In addition to being vice president of Anaconda, he was vice president of the Butte Anaconda & Pacific Railway, president of the Kenwood Realty Co., and vice president of the Interstate Lumber Co., and Montana Hardware Co. He was a director of the Montana Power Co., Metals Bank & Trust Co., Butte YMCA and the Butte Chamber of Commerce.


***Solving wet gravity ore recovery, sizing and separating problems since 1912.***

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DEISTER MACHINE CO., Fort Wayne 4, Indiana

# TEAMED UP FOR *Faster* INSTALLATION

NAYLOR Spiralweld pipe and NAYLOR one-piece Wedgelock couplings give you just what it takes to make up dependable lines in a hurry. The light weight of the pipe simplifies handling and assembly, while the simplicity of the Wedgelock coupling provides the fastest, most economical method of pipe connection available today.

Whatever your mining operation needs may be—water, tailings, air or ventilating lines—it will pay you to consider the extra performance of this NAYLOR combination.

**Write for Bulletin No. 59 for pipe and coupling information.**

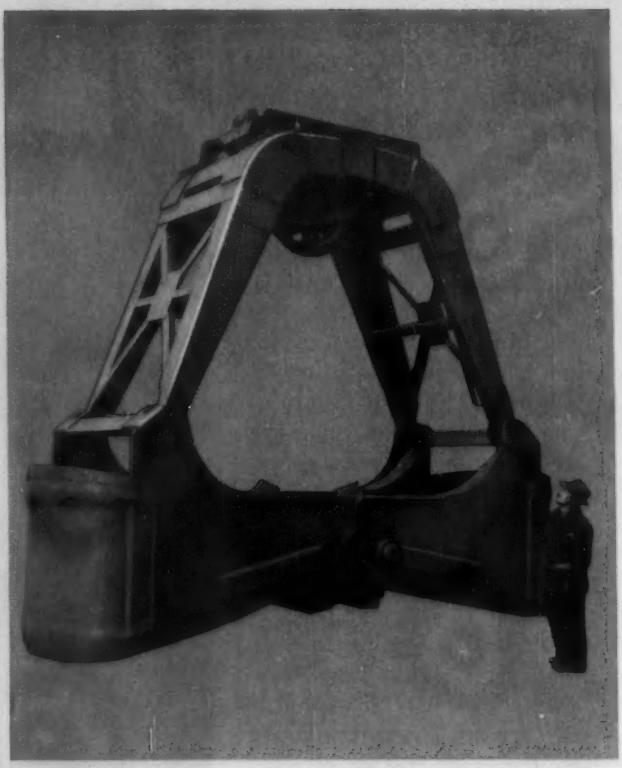
The NAYLOR Heavy-duty Wedgelock coupling makes a positive connection—can not slip out of standard weight grooved ends. A hammer is the only tool required to connect or disconnect it. Low-pressure type also available.

**NAYLOR PIPE** *Company*

1243 East 92nd Street, Chicago 19, Illinois

**Eastern U. S. and Foreign Sales Office:** 60 East 42nd Street, New York 17, N. Y.

# Blaw-Knox
# 4-rope Ore Buckets
# for low-cost fast handling



Blaw-Knox 4-rope Ore Buckets are designed and built for heavy duty service. Upper and lower sheave assemblies are completely assembled independent of the bucket. The upper assembly is equipped with close packed anti-friction bearings for maximum stability.

Scoop hinge members are ruggedly built to withstand severe side bumps and retain true alignment. Geared hinge-type corner bars are of welded construction reinforced with angles at the outer rear corners.

A Blaw-Knox bucket engineer will be glad to discuss your materials handling problem and help select the bucket best suited to your needs.

**WRITE TODAY!** Bulletin 2392 contains valuable information on Blaw-Knox 4-Rope Buckets for ore handling.

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*Blaw-Knox Equipment Division*
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for small mines, offering low first cost and operating economies.

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are SAFE and AUTOMATIC

Mayo-designed, cast steel coupler for narrow gauge mine cars hooks on in seconds automatically from any position. Completely eliminates all hazards of hand coupling, saves time. Easily bolted to existing cars. Costs about half of comparable equipment.

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17-59

***Stone quarry owner rates Chevrolet best at saving money***

# "My '59 Chevies move more material at less cost than any other make I've had."

—R. G. SNYDER,
SNYDER STONE QUARRY,
MARTINSVILLE, VIRGINIA

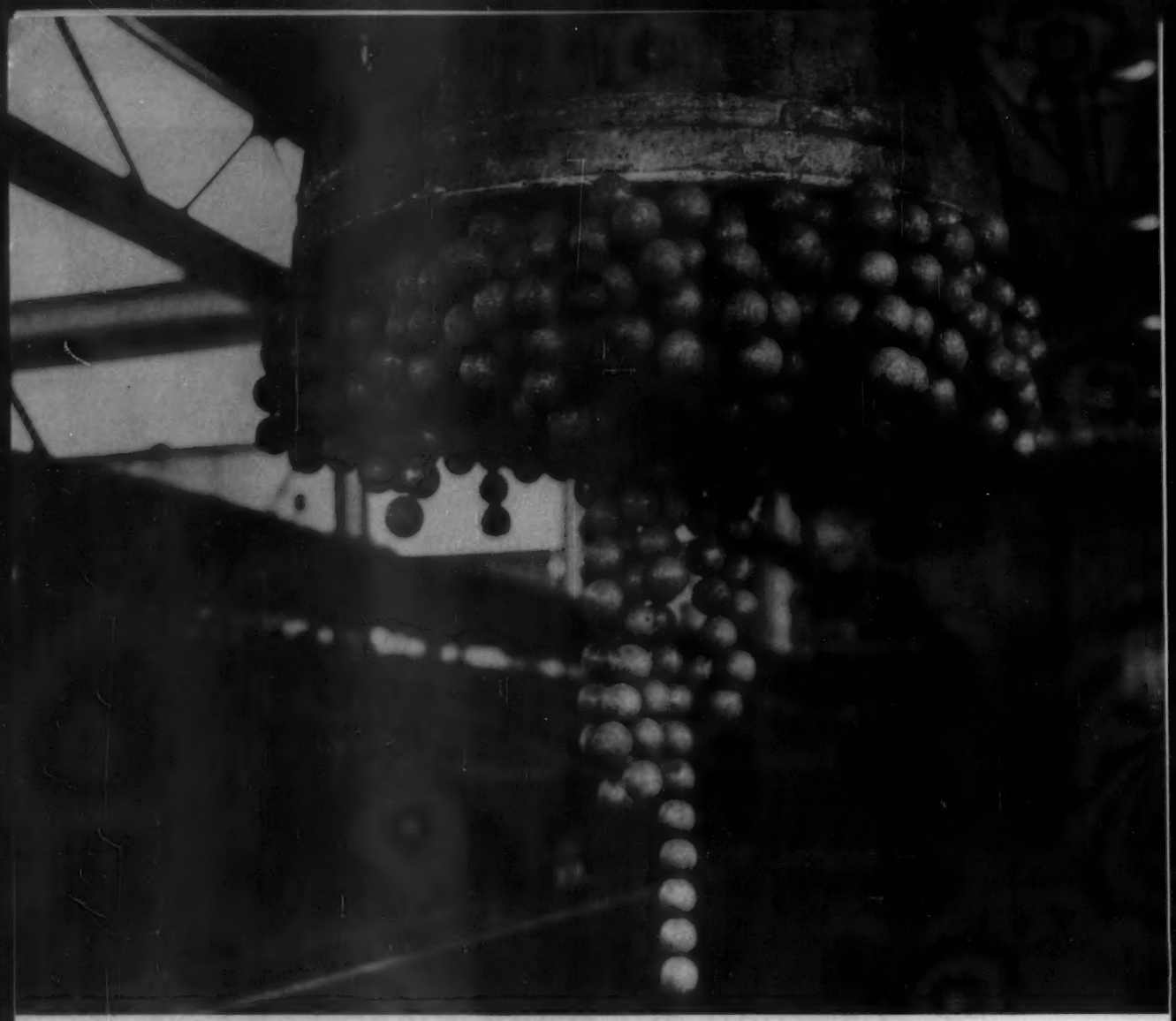
"Put a Chevrolet out on the job and it'll stay there. Upkeep costs are at a low minimum. You never do wear one out; you just get tired of looking at it and buy a new one.

"I move material at less cost per mile with this '59 Chevrolet than any other make of truck I've ever had. And it'll move over the road with a full load as fast as a light truck. Chevrolet trucks get better and better every year. I've never seen a more dependable truck than this '59. Keeps going and going with no downtime at all for major service work."

Chevy, you'll find, is winning a lot of new boosters among mining and quarry men, for a number of good reasons. Reasons like money-saving *power*, for instance. Chevrolet for '59 offers newly improved valve-in-head 6's that nurse a gallon of gas like nothing in trucks has before. Or big V8's for every Series that include the shortest stroke design—the best saving design—in the field. And for the *toughness* that leads to low maintenance, Chevy's advanced chassis components are specially designed for the capacity to out-muscle the roughest kind of runs. For the *latest* in low-cost hauling equipment, see your Chevy dealer! . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET

## No job's too tough for a Chevrolet truck!



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We did. The grinding balls were packed in drums, shipped via truck, and arrived at the Indiana plant on the morning of the day they needed them.

Though most companies place orders for grinding balls two to three months in advance, there are always emergencies . . . and United States Steel is ready to help you when that emergency develops. A complete stock of USS Carbon-Manganese Steel and USS Alloy Steel Grinding Balls is maintained at all times.

We can ship grinding balls almost any way you like: In 100-pound capacity burlap bags; in 2,000-pound capacity steel drums; in semi-trailer or dump trucks; in gondola or box cars (loose or in containers); or you can send your own truck if you like. The next time you need grinding balls contact the United States Steel sales office nearest you, or write or call United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

*USS is a registered trademark*

USS

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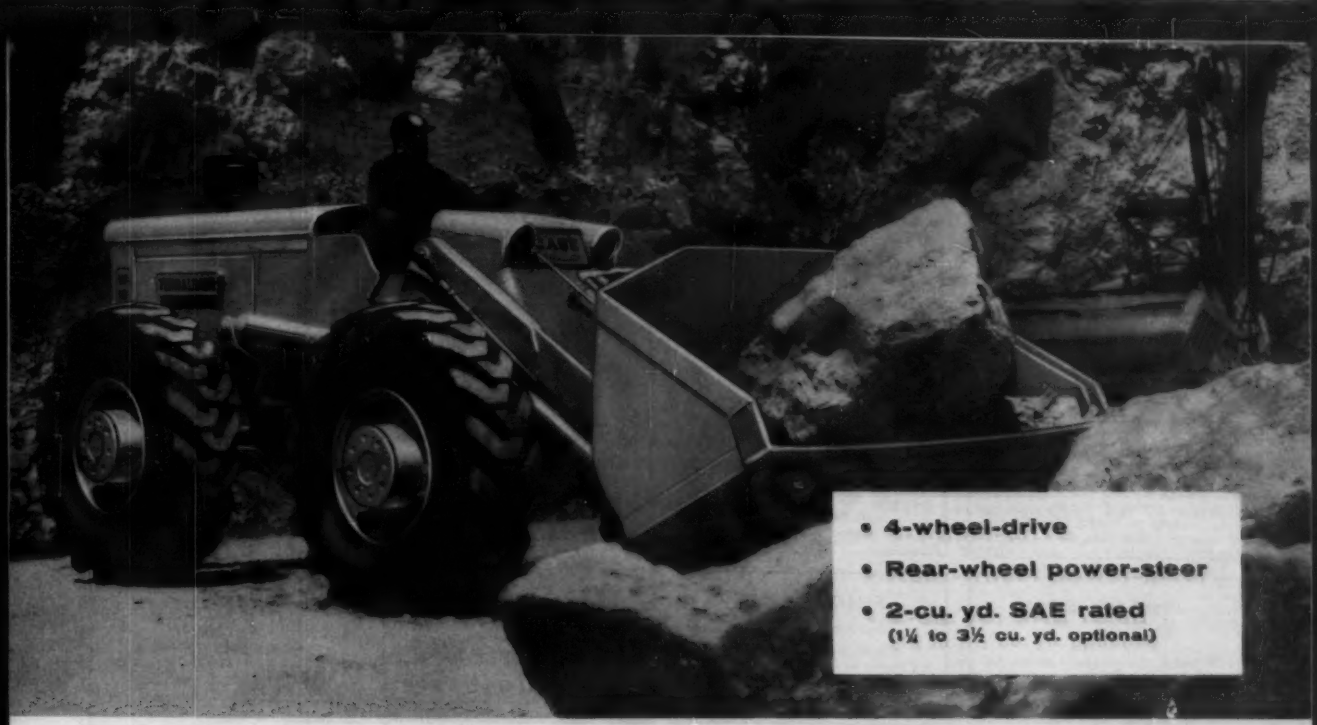
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Export Company

**United States Steel**

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## totally balanced for . . .

**GREATER WORK OUTPUT**

Balanced power-to-weight ratio . . . exactly the right combination of engine power, traction and machine weight . . . insures faster digging . . . with minimum wheel slippage.

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Balanced weight distribution, with 60% of empty weight on rear wheels, provides greater ground-gripping traction. No bucking or raising rear wheels off ground. This, combined with torque-converter drive and powerful breakout, gets heaped loads fast. Clustered shuttle-shift and speed range controls give operator efficient one-handed control of direction and operating speeds.

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Brake, electrical and steering systems are all easily accessible by merely removing front cover plate. Multiple engine cylinder heads and removable wet-type sleeves permit servicing without pulling engine.

**SAFER HANDLING**

Note that the W-10 loader arms are pivoted *ahead* of operator. This exclusive feature gives unequalled visibility, plus maximum operator safety. Better weight distribution, low center of gravity and wide-tread stability mean greater safety and permits moving bigger loads at higher speeds . . . less bouncing.

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With all its advanced features, the W-10 is priced *lower* than its nearest competitor. That's because Case builds the entire unit . . . including engine. Unit construction also means one warranty, one service source . . . no split responsibility.

## WORLD-FAMOUS 100 hp CASE DIESEL

**gives you better performance with greater economy**

★ **POWRCEL combustion** — cleaner burning, smoother running, greater economy.

★ **Six-point fuel filtration,** plus dry-type air filter which reduces dirt intake more than 90% over oil-bath cleaners.

★ **Extra-heavy, ribbed engine block** — gives more rigid engine, reduces flexing and results in less internal wear.

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★ **Multiple cylinder heads** — prevent warping, make servicing easy.

*Find out for yourself what the new W-10 can do on your job. Your Case Industrial Dealer will arrange a demonstration. Call today or mail coupon.*

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25 MN3D Ingersoll Rand Hoist

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38—20 cu. ft. Rocker Dump 18" ga.
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1—26 cu. ft. Card Granby Type 24" ga.
11—28 cu. ft. Morse Bros. Side Dump 24" ga.
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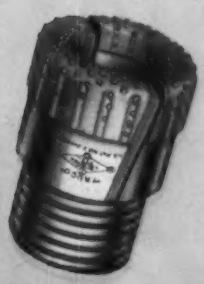
Time was when the setter took the actual bit blank, scribed the pattern, drilled an individual hole for each diamond, set the diamond in, tapped it home, peened in the edges of the hole and, although the technique sounds primitive, turned out a pretty good bit. That was "hand setting".

Nowadays, he starts with a beautiful solid carbon mold in which the location of each diamond is a precisely spotted cavity. Into each cavity he sets the selected diamond and he still sets it "best face to the work".

This is called "mechanical setting" because it has the advantage of the precise carbon mold. But, for all this modern mechanization, it still has the all-important advantage of an expert eye and a practiced hand placing each diamond as it *must* be placed for top performance.

The Truco Bits resulting from this combination of mechanization, skill and experience demonstrate their superiority in faster cutting, greater footage, higher salvage, lower diamond cost. Try a Truco and see for yourself.



**TRUCO DIAMOND BITS** *by*

**WHEEL TRUEING TOOL COMPANY**

**3200 W. Davison Avenue, Detroit 38, Michigan**

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
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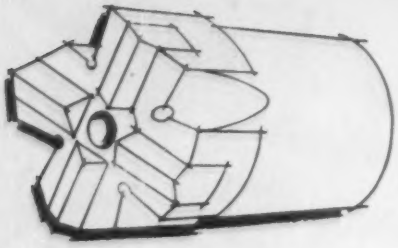
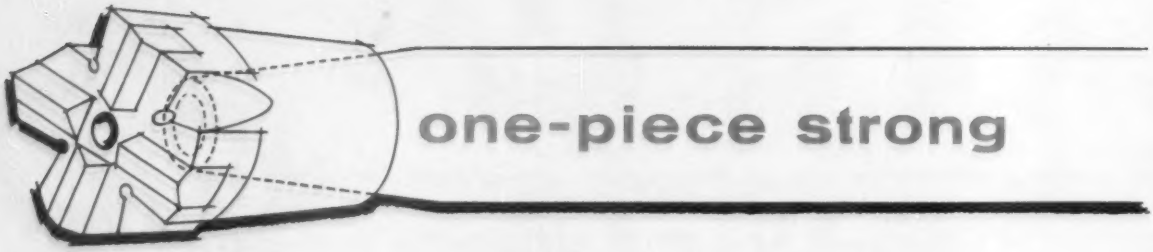
*MEMBER Diamond Core Drill Manufacturers Association*

# Switch to the new Timken® air-leg bit...save 4 ways on drilling costs because it's...



**Removable**

**yet**



**one-piece strong**

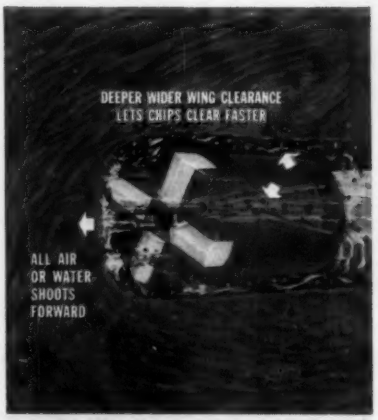
1. You save good drill steels when the carbides wear out because the new Timken® bit is removable. (With intrasets, you have to throw away good steels!)

2. You save work because a pocketful of Timken removable bits is enough for a whole day's work. (With intrasets, you haul an armful of steel!)

3. You save time because you can change bit gauge sizes fast on the same steel with the new Timken bit for air-legs. (With intrasets, you have to change the whole steel.)

4. You save on gauge wear, too. Timken removable bits give longer gauge wear because they have four cutting edges. Most intrasets have only two.

All these savings are yours when you use the new Timken tapered socket carbide insert bit for air-leg drills—*tapered* for one-piece strength. And you get faster chip clearance, too, because of the new features of the TTB, (see diagram at right). For free brochure on this new Timken air-leg bit, write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*




**CHIPS CLEAR FASTER** because 1) five front holes shoot water or air directly against the rock face and, 2) deeper, wider wing clearance lets chips wash back faster.

# TIMKEN® REMOVABLE ROCK BITS

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